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Telephone SPring 7-9364

AMERICAN
# DYESTUFF REPORTER

**DEVOTED TO TEXTILE WET-PROCESSING**

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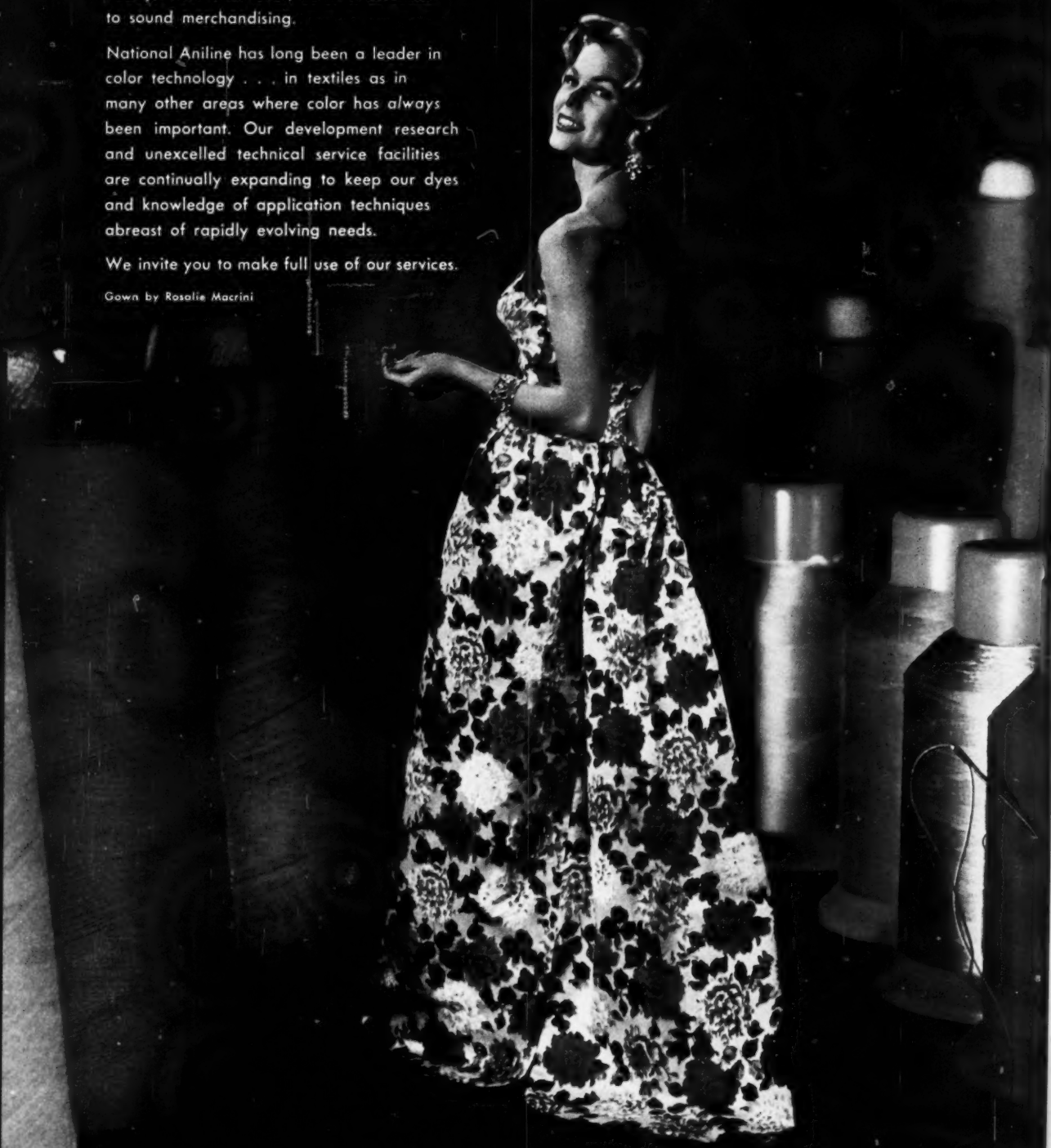

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# *Proceedings of the*
# American Association of Textile Chemists and Colorists

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FEBRUARY 25, 1957

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It is presumed that authors in studying the comments of reviewers and of the Editor will remember that all recommendations are made in a kindly, helpful, sympathetic manner to improve the paper in both literary and technical excellence. Although authors should cheerfully consider suggestions, they are expected to defend their position if justified, especially when strictly technical matters are involved with which the authors have an intimate knowledge.

AATCC strives to maintain a high scientific and professional standard for papers. Authors must make every effort to avoid the use of trade names, commercial products or process names wherever such use may be construed as advertising. Wherever possible, scientific nomenclature must be employed. It is recognized that in some instances trade names are necessary to avoid lengthy description. Certain trade names have been so widely used as to become generic and these normally are permissible. Further, some technical papers may involve the presentation of a new product or process wherein trade name reference is obligatory.

Giving due consideration to such valid exceptions, it is incumbent upon the author to maintain the proper scientific attitude, avoiding any expressions or devices aimed at promoting a particular product or process.

Questionable papers are to be referred to the chairman of the Publications Committee, who will submit them to an editorial board which would be appointed as needed. The Board would report to the Publications Committee, which would have the final voice in accepting or rejecting a paper.

MANUSCRIPTS — Manuscripts shall be typewritten double-spaced with approximately one-inch margins on 8.5x11-inch white paper. In addition to the *original*, at least one carbon copy is required. Pages are to be numbered consecutively with Arabic numerals, and each page after the first shall carry the authorship at the very top. Tables and figures shall also be numbered consecutively, the tables with headings containing Roman numerals as TABLE I, TABLE II, etc, and the figures with Arabic numerals as Figure 1, Figure 2, etc, appearing *below* the figures. The names of the authors and their laboratories or business connections should appear below the title of the paper.

LITERARY STYLE AND FORM OF PRESENTATION—In the writing of papers, authors are requested to observe a trenchant, simple style of writing directed to textile chemists and colorists with at least an elementary knowledge of chemistry, physics, mathematics, engineering, textile processes and textile machinery.

In the organization of the material, there should be one or more introductory paragraphs setting forth the occasion, significance and main objectives of the paper and of the method of attack. This should be followed by the body of the presentation, either with discussions interspersed throughout this portion or with a collected section marked "DISCUSSION" after the main body of the paper. Finally, there may be a brief section at the end entitled "SUMMARY" or "CONCLUSIONS."

Center and side headings make for easier reading. Center headings should be employed sparingly and generally will include only very important section headings, such as "INTRODUCTION," "EXPERIMENTAL," "DISCUSSION," "CONCLUSIONS," "SUMMARY," and "REFERENCES." Side headings (see sixth paragraph of this *Notice* for an example) shall be indented and run into the text to which they apply, and shall be separated from the paragraph by a dash. The publisher will print center headings in bold-face capitals and side headings in capitals.

LITERATURE REFERENCES AND FOOTNOTES—References to the literature and all footnotes (except those in tables) shall be numbered consecutively with underlined Arabic numerals in parentheses at the proper place in the text. Where a reference or footnote is to be used again, the original number is simply repeated; this obviates the necessity of repeating the footnote or reference at the bottom of the page. References to the literature shall conform to the universal usages followed by *Chemical Abstracts*, which include underlining of journal names to indicate italicization in printing.

The spelling and rules of punctuation followed in manuscripts shall be those found in the "Merriam-Webster New International Dictionary"; abbreviations and chemical formulas shall conform to *Chemical Abstracts*.

FIGURE AND GRAPHS—Figures and graphs should be black line drawings on white drawing paper. Photographic prints are acceptable, preferably glossy prints on double-weight paper. Duplicates should be available for dispatch to reviewers. In graphs the frame and actual curves should be inked more heavily than the co-ordinate lines, and these latter should not be too close together. Various styles of broken lines are sometimes desirable to distinguish curves. Experimental points should be given with small plane figures, such as circles, squares, diamonds or triangles. Numbers and legends on co-ordinate axes are to be lettered in the graph by the author. Numbers and titles of figures should be placed below the diagram or on the edge of the back. Each piece of illustration copy should bear on the margin or on the edge of the back the name of the author and the title of the paper.

SYNOPSIS—A separately written synopsis of not over 200 words containing the gist of the subject matter must accompany every manuscript.

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Rhode Island Section———

# THE FUTURE OF TEXTILES*

FRANK LESLIE
*Leslie and Company*
*Providence, RI*

WHILE I am honored by your invitation and delighted to be here, I cannot, in all candor, say, that my feelings are wholly unmixed. Considering the textile industry, in its widest sense, as one ranging from the raw material to the consumer, I came from the outer perimeter—just this side of the share-cropper—or you might describe it, from your point of view, as the Polar Regions, and I have all the ignorance of an Eskimo on the matters with which you are directly concerned.

Nevertheless, as you must know, ignorance has never been an inhibiting factor with any salesman. In this scientific age, where precise knowledge is a fetish or a necessity, depending on how you regard it, we are the last of the romantics. We generally find accurate information useful solely insofar as it gives an accidental validity to the imagination.

But imagination, as applied to merchandising, is in such scant supply in the textile industry, that anyone who purports to have even a modicum of it need not be fearful of a too critical reception. At least, there are no machines to test its tensile strength, or its fastness to light or its crease resistance.

You may well think that anyone who has the presumption to raise the question: "What Is the Future of Textiles?" with the obvious inference that he intends to provide some sort of an answer, must have an imagination bordering on delusion. You may be assured, at least, that we are not going through the looking-glass to find it; nor need you scramble for the exits on the suspicion that I am a government economist.

To come directly to the point, I believe that textiles have an excellent future—which means, of course, a profitable one—and that the future can be accelerated whenever we have the intelligence and imagination to stretch out our hand to meet it. This is a simple statement—which I meant it to be—but that the process of putting it into effect will be as simple as it sounds, I do by no means imply.

Modernizing our merchandising methods as we have already modernized our technology is rather a large cat to hang a bell on. Yet I believe it will be done because what must be done in this world eventually gets done, whatever the cost or travail. And we will do it in the textile industry because the antique pattern of overproduce and curtail, of famine and feast, which has begun its dreary cycle again, will not be tolerated by the investing public which has considerable and important funds in textile properties. We are going to have to learn to be merchants or else—or else make way for a new influx of executives from the fields of soap or deodorants or electric razors or washing machines—for men who, while they may have no knowledge of textiles as such, will have that indispensable qualification—the ability to sell a product.

After a dozen years of prosperity, which we could hardly avoid, we are again an ailing industry. I refer you to the low rate of return on invested textile capital and to those textile stocks which are selling on the stock exchange at about or even below their quick asset value. A mill, to take another instance, manufacturing carded staple cotton goods cannot be built today at less than $200 a spindle, and there are few such mills in existence showing an adequate return on a valuation of half that amount.

For this state of affairs we blame Japanese imports, government subsidies, indecisiveness of farm programs, tight money, the weather and cut-throat competition. I do not wish to minimize any of these factors; they are all contributory. But hasn't anyone noticed that we are also losing our market for textiles as well? In 1929, 14 cents of the consumer dollar went into apparel. In 1948, it had dropped to less than 12 cents. In 1954, it was 7.9 cents.

There used to be an old economic law that when people's income rises they tend to spend a higher proportion than formerly on apparel and a lower percentage on food. The food industry repealed that law. In the present period of rising prices, the exact reverse has been true, and it has been brought about, according to Professor McNair of the Harvard Business School, who made the survey, by "the difference in merchandising and promotion between the food and the soft goods field." In 1955, the food and food products industry spent 3.1% of its income on advertising and promotion. Clothing and accessories, the most widely promoted branch of the textile industry, spent 3 tenths of one percent.

The market before us has tremendous potentials. In an address before the ACMI Convention in Florida last spring, Arno H Johnson, vice president of J Walter Thompson Co, referring to the 20% increase in population and the 500 to 570 billion-dollar national income which most economists predict, stated:

"With the growth in our economy possible by 1965, the typical American family will be similar, or better than, the pre-war $3000 to $5000 type of family, in real purchasing power. This means that the potential per capita consumption of cotton and synthetic fibers would be 96% greater, on the average, than pre-war *if* families were educated to step up their standards of cloth consumption *just* to the level prevailing in the same income groups pre-war."

This means, in effect, that when the family moves up into the $5000-a-year class, we not only have to educate the Old Man to wear a shirt over his underwear when he watches television in the parlor, but we have to get that shirt on his back before the television industry by its promotion gets him in hock for a second television.

It is important, in our consideration, not to think that promotion is another word for advertising. Advertising is only one aspect of promotion. Advertising is the medium which carries the message; it is important that the message make sense as well as being literate and striking. To assure this, it is necessary to survey your markets; to make studies of the habits and motivations of the consumer. To give the public what

*Presented before the Rhode Island Section on December 6, 1956 at Johnson's Hummocks Grill, Providence, RI.

Stern

Steed

Nelson

Bradley

Brumberger

Green

**Jerome Stern** and **Charles J Steed, Jr** have been promoted to sales supervisors for the east and midwest respectively for National Starch's Resin Division.

Mr Stern joined National's New Products Development group in 1951, later becoming product supervisor, specializing in the promotion and sale of vinyl copolymers as well as developing several of National Starch's resin applications. He will continue to operate from the Plainfield, NJ, sales office.

Mr Steed has represented National in the Midwest area for the past three years in the sale of vinyl resins. His headquarters will continue to be in Chicago.

---

**Arthur D H Ward,** formerly with Fox-Wells Co Inc as quality control, sales and development expert for the past ten years, will join the staff of Northern Dyeing Corp, Washington, N J, on February 1. He will be in charge of sales promotion and serve also as a construction technician.

---

Two research and development chemists and a technical sales representative have been added to the staff of the Coatings and Adhesives Department of the Borden Company's Chemical Division.

The research and development chemists are **Charles W Bayley, Jr,** who will work on latex, and **Austin I Weber,** who will specialize on coatings. **Philip E Coyle, Jr,** is the new technical sales representative, who will cover the Eastern New England territory.

Mr Bayley comes to Borden's after long activity in the latex field. He formerly was chief chemist at Dee's Adhesives and Chemical Company, Inc, Lynn, Mass, and research and development chemist for General Latex and Chemical Corporation, Cambridge, Mass.

Mr Weber was formerly with the Gates Engineering Co, Wilmington, Del, where he served as a development chemist.

Mr Coyle has been with the United Shoe Machinery Corp and the Heveatex Corp.

**Dewey H Nelson,** formerly assistant to the sales manager, has been promoted to sales manager of Becco Chemical Division, Food Machinery and Chemical Corporation, Buffalo, NY. He succeeds the late **John F Shea,** who was vice-president in charge of sales at the time of his death on November 26, 1956.

---

**Joseph F Bradley,** associated for the last five years with Woonsocket Color & Chemical Co, recently joined Francolor, Inc, Division of Compagnie Francaise des Matieres Colorantes, in the capacity of technical sales representative.

In his new capacity, Mr Bradley will be in charge of the new laboratory, which has been established by Francolor, Inc, in its offices at 162 Main Street, Woonsocket, RI. In addition, Mr Bradley will be visiting the trade in the Blackstone Valley Area of Central Massachusetts, Rhode Island, and in the Fall River area of Massachusetts.

---

**Fred M Rawicz,** vice chairman of the North Carolina State College Student Chapter, AATCC, has been named the winner of the 1957-8 Celanese Corp of America Fellowship at N C State College's School of Textiles.

Rawicz will receive a $1,800 academic award covering one year of graduate study.

---

Crest Chemical Corporation, Newark, N J, has announced the election of **Maurice Grayson** as partner and director in charge of all sales. Mr Grayson has been in the textile field for over twenty-five years.

The appointment of **William R Calabrese** as district sales manager was announced at the same time.

---

**Edwin Schlesinger,** formerly chief design engineer, has been appointed manager of the Engineering Department of the Dyestuff and Chemical Division Plant of General Aniline & Film Corporation at Linden, NJ.

**Robert C Brumberger** has been appointed manager of chemical industry sales for Nuodex Products Co, a division of Heyden Newport Chemical Corporation.

From 1950 to 1955 Mr Brumberger was associated with Nuodex as manager of industrial fungicides and as chemical industry manager. From 1955 to 1957 he was a special representative for Rexton Finishes Inc.

---

The management of Imperial Paper and Color Corp, Pigment Color Division, Glens Falls, NY, has announced the appointment of **Floyd W Green** to the position of director of technical service. Dr Green brings to his new assignment a technical background gained from fifteen years in the Corporation's Research Laboratory. In his new position he will direct the activities of the Technical Service Laboratory.

---

**Raymond J Lodge** and **Charles W Smith** have been appointed department general managers for the Borden Company's Chemical Division. Mr Lodge now heads up the Resins and Chemicals Department, and Mr Smith, the Polyco-Monomer Department. **Eugene J Sullivan,** who has been top administrator for both departments, recently was advanced to general sales manager for the entire Chemical Division.

Mr Lodge, a Borden 20-year man, has held a number of sales and administrative posts in the Chemical Division. Most recently, he was general sales manager for the Polyco-Monomer Department.

Mr Smith joined Borden's in 1951 as head of chemical engineering at Bainbridge, N Y. In 1956 he became assistant general manager for both the Resins and Chemicals and Polyco-Monomer Departments.

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**Raymond G Haislip,** formerly with Geigy Chemical Corp as a chemist and demonstrator at Charlotte, N C, for four years, has been named Southern representative for United Aniline Co.

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# *Proceedings of the*
# American Association of Textile Chemists and Colorists

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FEBRUARY 25, 1957

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Rhode Island Section———

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# THE FUTURE OF TEXTILES*

FRANK LESLIE
*Leslie and Company*
*Providence, RI*

WHILE I am honored by your invitation and delighted to be here, I cannot, in all candor, say, that my feelings are wholly unmixed. Considering the textile industry, in its widest sense, as one ranging from the raw material to the consumer, I came from the outer perimeter—just this side of the share-cropper—or you might describe it, from your point of view, as the Polar Regions, and I have all the ignorance of an Eskimo on the matters with which you are directly concerned.

Nevertheless, as you must know, ignorance has never been an inhibiting factor with any salesman. In this scientific age, where precise knowledge is a fetish or a necessity, depending on how you regard it, we are the last of the romantics. We generally find accurate information useful solely insofar as it gives an accidental validity to the imagination.

But imagination, as applied to merchandising, is in such scant supply in the textile industry, that anyone who purports to have even a modicum of it need not be fearful of a too critical reception. At least, there are no machines to test its tensile strength, or its fastness to light or its crease resistance.

You may well think that anyone who has the presumption to raise the question: "What Is the Future of Textiles?" with the obvious inference that he intends to provide some sort of an answer, must have an imagination bordering on delusion. You may be assured, at least, that we are not going through the looking-glass to find it; nor need you scramble for the exits on the suspicion that I am a government economist.

To come directly to the point, I believe that textiles have an excellent future—which means, of course, a profitable one—and that the future can be accelerated whenever we have the intelligence and imagination to stretch out our hand to meet it. This is a simple statement—which I meant it to be—but that the process of putting it into effect will be as simple as it sounds, I do by no means imply.

Modernizing our merchandising methods as we have already modernized our technology is rather a large cat to hang a bell on. Yet I believe it will be done because what must be done in this world eventually gets done, whatever the cost or travail. And we will do it in the textile industry because the antique pattern of overproduce and curtail, of famine and feast, which has begun its dreary cycle again, will not be tolerated by the investing public which has considerable and important funds in textile properties. We are going to have to learn to be merchants or else—or else make way for a new influx of executives from the fields of soap or deodorants or electric razors or washing machines—for men who, while they may have no knowledge of textiles as such, will have that indispensable qualification—the ability to sell a product.

After a dozen years of prosperity, which we could hardly avoid, we are again an ailing industry. I refer you to the low rate of return on invested textile capital and to those textile stocks which are selling on the stock exchange at about or even below their quick asset value. A mill, to take another instance, manufacturing carded staple cotton goods cannot be built today at less than $200 a spindle, and there are few such mills in existence showing an adequate return on a valuation of half that amount.

For this state of affairs we blame Japanese imports, government subsidies, indecisiveness of farm programs, tight money, the weather and cut-throat competition. I do not wish to minimize any of these factors; they are all contributory. But hasn't anyone noticed that we are also losing our market for textiles as well? In 1929, 14 cents of the consumer dollar went into apparel. In 1948, it had dropped to less than 12 cents. In 1954, it was 7.9 cents.

There used to be an old economic law that when people's income rises they tend to spend a higher proportion than formerly on apparel and a lower percentage on food. The food industry repealed that law. In the present period of rising prices, the exact reverse has been true, and it has been brought about, according to Professor McNair of the Harvard Business School, who made the survey, by "the difference in merchandising and promotion between the food and the soft goods field." In 1955, the food and food products industry spent 3.1% of its income on advertising and promotion. Clothing and accessories, the most widely promoted branch of the textile industry, spent 3 tenths of one percent.

The market before us has tremendous potentials. In an address before the ACMI Convention in Florida last spring, Arno H Johnson, vice president of J Walter Thompson Co, referring to the 20% increase in population and the 500 to 570 billion-dollar national income which most economists predict, stated:

"With the growth in our economy possible by 1965, the typical American family will be similar, or better than, the pre-war $3000 to $5000 type of family, in real purchasing power. This means that the potential per capita consumption of cotton and synthetic fibers would be 96% greater, on the average, than pre-war *if* families were educated to step up their standards of cloth consumption *just* to the level prevailing in the same income groups pre-war."

This means, in effect, that when the family moves up into the $5000-a-year class, we not only have to educate the Old Man to wear a shirt over his underwear when he watches television in the parlor, but we have to get that shirt on his back before the television industry by its promotion gets him in hock for a second television.

It is important, in our consideration, not to think that promotion is another word for advertising. Advertising is only one aspect of promotion. Advertising is the medium which carries the message; it is important that the message make sense as well as being literate and striking. To assure this, it is necessary to survey your markets; to make studies of the habits and motivations of the consumer. To give the public what

*Presented before the Rhode Island Section on December 6, 1956 at Johnson's Hummocks Grill, Providence, RI.

it wants is never difficult if you happen to have it; but to make the public want what you can give is the art of merchandising.

For the purpose of pin-pointing our problem, let us consider the textile apparel market. This market seems to offer the greatest opportunity in terms of volume. If we would begin at the core of the problem, we must start by viewing the various economic and cultural trends that will be for or against the sales of textiles over the next few years. It would be advisable, too, I think, to confine ourselves for present purposes and for brevity to women's wear.

It is evident to everyone connected with textiles and apparel that there have been vast changes in consumer interest and buying patterns in the past decade—a veritable economic and cultural revolution. Before we can have an effective program directed to the contemporary consumer, we must first probe the factors that have brought this economic and cultural revolution about.

The prosperity of our economy has made us a nation of selective buyers. A family on the relief rolls could provide only for the necessities of life in food, shelter and clothing—and clothing merely to the extent of adequate covering for the body. Today practically every family can provide these necessities and, in addition, has a considerable portion left over for selective buying; an extra dress, an electric ironer, a new suit or the down payment on a car.

The extent to which this selective buying has grown has brought with it a virtually classless society where everyone has more of everything. The tremendous growth of population, family-centered attitudes, the automobile, the quest for better living have created the trend to Suburbia. Increased leisure has brought a greater interest in travel and sports. All this has had its effect on the way apparel is regarded.

For example, the move to Suburbia has definitely been a factor in the carefree attitude and growth of "casual" attire. The increase in the number of children per family, with its resulting strain on the family budget, the disappearance of domestic help, and the desire for purchasing home appliances, have increased this casual attitude toward clothes.

Yet, in a luxury economy, such as ours, I think we shall have to look deeper than the effect of suburban living to explain the subordinate role which clothing now plays in the American way of life. Fifty years ago, if you stood for an hour on the main corner of any American town on a fair morning, you could pick out the town's banker by his frock-coat, his striped pants, the white-piping on his vest—the lawyer by his blue serge suit and high stiff collar—the leading store-keeper by his serviceable tweeds—and, if their wives were about at the same hour, I am certain that any woman observer could have identified them as readily. So, when we consider what are the cultural, economic and phychological factors which are responsible for the decline in the "clothes-consciousness", I think that one of the important answers will be that a well-dressed man or woman is no longer the measure of a family of means or culture. The automobile, the ranch house and the color television speak for them instead. Clothes, it seems, have lost much of their built-in prestige of former years.

Now this, of course, is only one of many contributing causes to the decline in the importance of clothing in the scale of living. It will be important to study what the others are, and our promotional efforts must be a combination of appeals. Only in this way can we motivate the rediscovery of the pleasure and advantage in purchasing more apparel.

A good beginning might be with the housewife. We know that for lack of effort, and hidden resistances, a majority of today's women "at home" remain in the same attire—the same pair of jeans, shorts or house-dress, day in and day out. We could show her how she can be pretty as well as practical. Show her why she should not be content to let worn or unattractive garments "make do for housekeeping and leisure activities."

A program could be developed to stimulate the promotion of apparel designed with the housewife in mind: fabrics and dresses that are comfortable for housekeeping tasks; garments designed with convenient pockets; clothing that is attractive yet practical for tending the baby or gardening; for shopping in all kinds of weather. We could show 50 million housewives that, midway between her blue jeans and her occasional need for an evening dress, there is a wealth of clothing she could possess; a wealth of apparel she *should* buy for the sake of her family, her own pride and for the fun of looking and feeling attractive at all times.

Some of you may ask, "how does this kind of advertising or promotion differ from what we are presently doing?" It differs in this way: At present we are giving the housewife what she asks for with little, if any, consideration towards widening or increasing the scope of her desires. She wants a garment that she does not have to iron after taking it out of the washing machine; so you advertise that your crease-resistant finish is better than your competitor's. She wants blue jeans that will wear a long time, particularly since she is indifferent to how they look; so you emphasize all the abrasive tests which your blue jeans have passed. She wants a cheap wrap-around for home-wear; so when some cotton program puts the price of eighty squares higher, you print some sixty-eight-seventy-two's in order not to increase the cost of the garment.

One Sunday last spring, I had a reason for studing the magazine section of the *New York Times*. It contained nineteen textile ads. Eighteen of them promoted originality of design and styling, wearability, washability and, of course, crease-resistance. They were, without exception, attractive presentations, brilliantly conceived and expertly executed. A woman reading through those pages would find it difficult to choose one fabric over another.

There was one ad which had a different emphasis. A group of snooty, disembosomed models gazed down their noses with the usual bovine placidity while a few wolfish males simpered happily in the background. It read: "This is the season for a backward glance at a pretty girl. Ladies will be counting on their grand exits as well as their entrances." This is, also, the kind of motivation approach which makes a woman acutely conscious of the inadequacy of her entire wardrobe. It sends her avid and eager into the market for textiles as such, and while the motivation is as old as Eve's fig-leaves, we can give it new life by reviving its intensity.

Consider the promotions that have been motivated by fear. Fear of losing one's hair, one's teeth, of body-odor or of wrinkles. Or how the automobile industry has built itself up from a mere mode of transportation into a symbol of prestige and luxury. Automobiles, in the ads, are always parked outside the country club or pulling away from the opera or driving along a palm-lined parkway—never backing out of a mud-hole. They have "dynamic styling or dramatic interiors." If they have any engines at all, they either "glide" or "purr" or "throb"—words you will hardly find in the vocabulary of the average garage mechanic.

*(concluded on page P135)*

Perkin Centennial———

# THE INTERNAL APPLICATION OF COLOR IN THE MANUFACTURE OF MAN-MADE FIBERS*

CANADIAN ASSOCIATION OF TEXTILE COLOURISTS AND CHEMISTS

EMMANUEL I BIRNBAUM
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This paper presents a brief historical account of the invention, development, and commercial growth of a number of the more important man-made fibers. It recounts early efforts to incorporate colored pigments into the liquid or molten mass from which textile fibers are spun. More recent and current methods for production of "dope-dyed" man-made fibers are discussed in a general manner.

The importance of pigment particle type and size is indicated in relation to color yield in "dope-dyed" fibers. Methods for obtaining fine pigment dispersions are critically examined.

Various specific methods, depending on the nature of the fiber, are described for incorporating pigment dispersions into man-made fiber dope. The pigments involved are classified as to their chemical nature.

Physical properties of some commercially available "dope-dyed" man-made fibers are tabulated and the significance of these properties in terms of end-use performance is discussed.

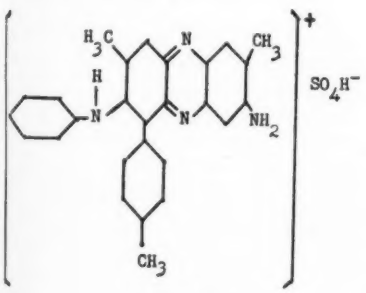
It is pointed out that internal application of color in the manufacture of man-made fibers has resulted in a more permanently colorful world than has been available previously. The authors forecast a promising future for this type of fiber. A bibliography is appended.

## INTRODUCTION

ONE hundred years ago, William Henry Perkin, at the age of 18, synthesized the dye Mauveine, first of the so-called coal-tar colors. By this invention there was founded the synthetic organic chemicals industry which, during the past century, has grown at an ever-accelerating rate. In the field of synthetic dyes alone, some 30,000 have been discovered since that momentous Easter vacation day in 1856, when Perkin treated a dilute solution of crude aniline sulfate with bichromate of potash and obtained a black precipitate.

Aiming to produce quinine synthetically, instead he found that by extracting the precipitate first with coal-tar naphtha and then with alcohol, he obtained from the latter "a beautiful purple coloring-matter which was capable of dyeing silk and other materials." It was in fact the dye we now know as "Mauve". The dye was originally called "Aniline Purple" or "Tyrian Purple", and it was apparently the French who coined the names "Mauve" and "Mauveine".

Subsequent research work by others, on the group of synthetic dyes which can be produced from crude aniline, showed that Perkin Mauveine or Mauve (*CI* 846) has the following chemical structure (*1*):




**Mauveine**

On August 26, 1856, Perkin obtained a patent (*2*) for "Producing a new Coloring[1] Matter for Dyeing with a Lilac or Purple Color, Stuffs of Silk, Cotton, Wool, or Other Materials". It is interesting to note that Perkin mentions in his patent not only aniline sulfate, but also the sulfates of toluidine, xylidene and cumidine, or mixtures thereof, as starting materials. Later researches have shown the presence of toluidines are essential to the synthesis (*1*).

Perkin's method of dyeing was relatively simple. The solid bronze-colored dye was powdered with a given quantity of oxalic or tartaric acid, moistened with alcohol and dissolved in boiling water. The fabric to be dyed was then introduced and when the dye solution was exhausted, the fabric was washed with water, and dried. Perkin stated, "the materials thus dyed are of a lilac or purple color of a very durable character, the tints or shades of which may be varied by the quantity of coloring matter used".

Perkin, with the aid of his father and his elder brother, purchased a site at Greenford Green, near Harrow, and commenced erection of a factory to manufacture Mauveine in June 1857. The dye was supplied commercially for silk dyeing as early as December 1857. Because it produced a beautiful color previously unobtainable, Mauveine commanded a very high price for a number of years. In 1860, the price of Mauveine in the United States ranged between $250 and $325 per pound.

The manufacturing venture was a success and in due course other dyes were also made at Greenford Green. Perkin's last great contribution to the synthetic dye industry was in 1869 when he patented a process for manufacture of alizarin, a red dye previously obtained from the madder root. In 1873, at the age of 36, Perkin retired from industry and returned to scientific research. During his lifetime he received many honors. On the occasion of the Golden Jubilee celebration of the discovery of Mauveine in 1906, Perkin was knighted by King Edward VII. He was present in person at the celebrations held both in London and in New York. Only a few short months after his American visit Sir William Henry Perkin died at Harrow, England, in July 1907.[2].

MAN-MADE FIBERS———In 1856, when Perkin invented Mauveine, commercial man-made fibers were unknown. The idea of producing a

* Presented by C E Coke on September 13, 1956 during the Perkin Centennial celebration at the Waldorf Astoria, New York, NY

[1] Perkin's spelling of "Color" in his original patent.

[2] A very interesting account of the life and work of Perkin was written by Rowe in 1937 (*4*).

man-made fiber appears to have first come from a suggestion made by an English scientist, Dr Robert Hooke, in his book "Micrographia" published in 1664. He wrote, "And I have often thought, that probably there might be a way found out, to make an artificial glutinous composition, much resembling, if not fully as good, nay better than that Excrement, or whatever other substance it be out of which, the Silk-worm wire-draws his clew." Nearly 200 years went by before any action was taken along the lines of Hooke's suggestions and predictions.

Ademars, a Swiss chemist, was granted the first English patent for making "artificial silk" in 1855. As his base material, he used nitrocellulose in solution, to which he further added a gum to simulate natural silk. However, it did not occur to him to extrude this material through an orifice. He was not successful in producing a commercial "artificial silk".

The English physicist and chemist, Sir Joseph W Swan, in 1877, while seeking a better carbonized filament for electric lamps, turned his attention to nitrocellulose in solution. He is credited with having been the first to force that material through fine orifices into a coagulating bath to make filaments. To reduce inflammability, the product was denitrated thus giving a regenerated cellulose fiber or yarn. However, his interests were mainly in the electrical field and he did not exploit his product for textile purposes.

At the great Paris Exposition of 1889, Count Hilaire de Chardonnet displayed fabrics made from nitrocellulose-process artificial silk. From there, he went on to manufacture the product commercially. Today, Chardonnet is known as "the father of the rayon industry," which commenced in 1891. Nitrocellulose-process artificial silk can be regarded as first of the man-made fibers. However, it is no longer in commercial production.

The second commercial method for manufacture of regenerated cellulose artificial silk was the cuprammonium process, which originated in Germany in 1898. Basically, the process consists of first preparing a cuprammonium solution. Cellulose, in the from of cotton linters or purified wood pulp, dissolves in this solution to give a thick viscous liquid. The latter is extruded through fine orifices into hot water to give a thread of regenerated cellulose. It was by a refinement of this process that man-made filaments which are finer than those from the silk worm were first produced.

Chronologically next in the series of commercial man-made fibers is viscose artificial silk. The viscose process was discovered by Cross and Bevan, two British chemists, who obtained a patent on the process in 1895. Briefly, the process consists of treating cotton linters or purified wood pulp with caustic soda, followed by treatment with carbon bisulfide, and then dissolving the product in caustic soda; thereby producing a thick viscous liquid called viscose. The liquid is extruded through a number of fine orifices into a coagulating bath containing sulfuric acid and other chemicals. The resulting thread or yarn, after purification, is pure regenerated cellulose. Cross and Bevan's patents were purchased by the British firm, Courtaulds Limited, who commenced commercial production of viscose rayon in 1904. In 1955, world production of regenerated cellulose fibers amounted to some four and a half billion pounds (*3*), of which well over 90% were produced by the viscose process. The above figure for regenerated cellulose is almost twice that of wool.

Last of the cellulose family of man-made fibers to become a commercial product was cellulose acetate. Raw material for the process is, again, cotton linters or wood pulp or a mixture thereof. A solution of cellulose acetate is produced by reacting the raw material with acetic acid and acetic anhydride. The cellulose acetate is then precipitated as solid white particles by running the solution into water. After being washed free of acid and dried, the white particles are dissolved in acetone. The thick colorless liquid obtained thereby is then extruded through fine orifices. Acetone is evaporated by hot air thus leaving filaments of cellulose acetate, and a thread or yarn is obtained. The product is an ester of cellulose.

While the basic process for manufacture of cellulose acetate was discovered in 1869 by Naudin and Schutzenberger, they were not concerned with its potential as a textile fiber. Later, in 1894, Cross and Bevan obtained a patent on the use of zinc chloride or sulfuric acid as a catalyst for the reaction. However, it was not until shortly after World War I that Henry and Camille Dreyfus successfully commenced, in England, commercial production of cellulose acetate fibers.

The name "rayon" was adopted in 1924 as "the generic name of filaments made from various solutions of modified cellulose by pressing or drawing the cellulose solution through an orifice and solidifying it in the form of a filament or filaments by means of some precipitating medium".

All the above mentioned fibers are based on cellulose as a raw material and the fibers consist of either regenerated cellulose, or cellulose acetate. In 1934, a DuPont research group headed by W H Carothers announced the discovery of nylon, first of the truly synthetic fibers. Six years later, nylon was available to the American textile industry for the production of full-fashioned hosiery. A brief twenty years following the discovery of nylon has seen a whole host of man-made fibers emerge on the commercial horizon. No attempt will be made here to name all of them nor to describe their methods of manufacture, but in Table I a chemical classification of some of the more important of this group is given.

This table cannot be looked upon as complete in any sense of the word. Today, there are almost one hundred companies engaged in the manufacture of man-made fibers. Other man-made fibers not listed above include those made from corn protein, from seaweed, from castor oil, and from glass. Adding together all the non-cellulosic man-made fibers, world production in 1955 amounted to 562 million pounds (*3*).

Research work in the field of man-made fibers is moving ahead at a rapid pace. From this work we may expect to see further improvements in the fibers already commercially available, as well as new fibers unknown to the textile industry today. Thus, in the field of man-made fibers, the suggestions and predictions made by Robert Hooke in 1664 have become a reality.

## INTERNAL COLORATION OF MAN-MADE FIBERS

GENERAL———Man-made fibers in which color has been applied internally to the fiber during its manufacture are variously referred to in the textile industry as dope-dyed, spin-dyed, spun-dyed, solution-dyed, spun-colored, and pigmented. It has been pointed out by Butterworth and Cluley (*5*) in a very comprehensive paper on spun-colored fibers and yarns that use of the word "dyed" is misleading because many of the coloring materials used for this purpose have no substantivity to the fiber. However, because the term spun-dyed is so firmly established on this continent it is used hereafter. Contrary to the conventional method of dyeing, where the dye must penetrate the substance of the fibers, spun-dyed fibers are produced by incorporating

**TABLE I**
**Synthetic Man-Made Fibers**

| | *Unit Structure* | *Chief Raw Materials* |
|---|---|---|
| i) | *POLYAMIDE:* | |
| | (a) $-CO-(CH_2)_4-CO-NH-(CH_2)_6-NH-$<br>Nylon 66.<br>Components are hexamethylene diamine and adipic acid. | Phenol or benzene, hydrogen, ammonia, caustic soda. |
| | (b) $-NH-(CH_2)_5-CO-$<br>Nylon 6, Caprolan<br>Components are cyclohexanone and hydroxylamine. | Phenol or benzene, hydrogen, ammonia, caustic soda. |
| ii) | *POLYESTER:*<br>$-CO-C_6H_4-CO-O-(CH_2)_2-O-$<br>Terylene or Dacron<br>Components are dimethyl terephthalate and ethylene glycol. | P-xylene, ethylene, methyl alcohol, caustic soda, chlorine, sodium carbonate, nitric acid. |
| iii) | *POLYACRYLIC:*<br>$-CH_2-\underset{\displaystyle CN}{\underset{\vert}{CH}}-$<br>Orlon, Acrilan, Creslan, Courtelle. | Ethylene or acetylene, hydrocyanic acid, chlorine, caustic soda, potassium bisulphate. Solvent such as dimethyl formamide in some cases. |
| iv) | *POLYVINYL CHLORIDE-ACETATE:*<br>$-CH_2-CHCOOCH_3-$ and $-CH_2-CHCl-$<br>Vinyon<br>Components are 90% polyvinyl chloride, and 10% polyvinyl acetate. | Ethylene, caustic soda, acetic acid, chlorine. |
| v) | *POLYVINYL-ACRYLIC:*<br>(a) $-CH_2-\underset{\displaystyle CN}{\underset{\vert}{CH}}-$ and $-CH_2-\underset{\displaystyle Cl}{\underset{\vert}{CH}}-$<br>Dynel<br>Components are 60% polyvinyl chloride and 40% polyacrylonitrile. | Ethylene, hydrocyanic acid, chlorine, caustic soda, potassium bisulfate, solvent, such as acetone. |
| | (b) $-CH_2-\underset{\displaystyle CN}{\underset{\vert}{CH}}-$ and $-CH_2-\underset{\displaystyle COOCH_3}{\underset{\vert}{CH}}-$<br>Acrilan<br>Components are 90% polyacrylonitrile and 10% polyvinyl acetate. | Ethylene, chlorine, caustic soda, hydrocyanic acid, potassium bisulfate, sodium acetate. |
| vi) | *POLYVINYL ALCOHOL:*<br>$-CH_2-\underset{\displaystyle OH}{\underset{\vert}{CH}}-$<br>Vinylon | Alcoholysis of polyvinyl acetate or other polyvinyl esters. |
| vii) | *POLYVINYLIDENE-VINYL:*<br>$-C(Cl_2)-CH_2-$ and $-CHCl-CH_2-$<br>Saran or Velon<br>Copolymer of 85% polyvinylidene chloride and 15% polyvinyl chloride. | Ethylene, chlorine, caustic soda. |
| viii) | *POLYETHYLENE:*<br>$-CH_2-CH_2-$ | Ethylene, polymerized at about 200° C and 2000 atm pressure, with catalyst. |

into the fiber dope, before spinning, a pigment or coloring material. The process is, therefore, of necessity, restricted to man-made fibers. However, it should be mentioned that in 1841 a suggestion was made that dyes be added to the diet of the silk-worm in order to produce colored silk (*6*).

In the early days of commercial manufacture of viscose rayon, which was available in bright luster only, great care was taken to filter and refilter the viscose dope to remove all traces of solid particles. Even today, it is common practice in the manufacture of almost all man-made fibers, when spun into fine filaments, to filter carefully before spinning. This is necessary because the orifices through which the fiber dope is spun may be as small as two thousandths of an inch in diameter. Therefore, the viscose rayon industry had to wait some twenty years before a process was worked out in 1927 by Stokes (*7*) to deluster the yarn by incorporating mineral oil into the viscose dope before spinning. This did not affect filtration nor did it hamper the spinning operation. The oil in the semidull yarn so produced could not be removed by conventional textile wet processing nor by laundering. Thus for the first time, so far as the viscose process is concerned, were foreign particles deliberately introduced into viscose dope on a commercial scale. Shortly after this discovery, titanium dioxide in extremely fine particle size became available to the industry. It was found that by replacing the oil with this pigment, an opaque dull luster fiber or yarn was obtained. Again, as with the mineral oil mentioned above, the pigment particles were so fine they passed through the filters and did not affect the spinning operation. This discovery set the pattern for incorporation of colored pigments into the spinning dope of the majority of man-made fibers.

Today, all spun-dyed viscose rayon is produced solely by the incorporation of pigments. Early work on the addition of the leuco form of vat dyes to viscose dope (*8*), the leuco form of sulfur dyes (*9*), and ester salts of leuco-vat dyes to viscose and cuprammonium dope (*10*) all presented either some manufacturing difficulties or did not give an entirely satisfactory product.

In the case of cellulose acetate fiber or yarn, Butterworth and Cluley (*5*) point out that the earliest patent reference to this fiber in spun-dyed form "appears to be that by Lederer (*11*) who, in 1903, described, among other substances, the addition of dye liquors, solid coloring matters, and metal dust to cellulose acetate solutions prior to extrusion and coagulation".

Fewer problems are presented in the manufacture of spun-dyed cellulose acetate fiber than for viscose because, with the latter, the coloring matter must withstand strong chemicals, such as caustic soda and sulfuric acid. Today, as is the case with viscose, the trend in spun-dyed cellulose acetate fibers is toward insoluble pigments. Acetone-soluble dyes give bright attractive shades at low concentrations, but they do not possess the fastness which is so characteristics of the most suitable pigments The pigments for cellulose acetate fiber are dispersed in cellulose acetate itself and are sold either in powder form or as acetone pastes, the latter containing about 10% each of pigment and cellulose acetate and 80% of acetone. Generally, organic pigments are preferred to inorganic since the latter tend to dull cellulosic fibers.

SYNTHETIC MAN-MADE SPUN-DYED FIBERS AND YARN——
At present, greater progress has been made in commercial production of spun-dyed viscose and acetate fibers and yarn than in the synthetic man-made field. However, the principles involved in producing the latter are in general similar to those for viscose and acetate. Certain of the synthetic man-made fibers and yarns are melt spun at relatively high temperatures, which means additional screening of the pigments to be certain they withstand the temperatures involved. However, even for viscose and acetate, the yarn or fiber, in fabric form, must withstand the elevated temperatures involved in ironing.

Spun-dyed nylon is available only in black at present. With this fiber, the colors must be stable to the temperature of the melt for the total duration of the process. Considerable research by color manufacturers and by the fiber producers is proceeding to provide a range of commercial colors.

Spun-dyed Orlon is commercial today in black only. The textile industry is well acquainted with the utility and

cost economy of a black internally colored fiber. Therefore, black is the logical initial production for any of the man-made fibers.

Dacron is not yet produced commercially in other than its natural color.

Dynel is currently available in a range of six colors: black, dark brown, light yellow, light taupe, grey and white. There is no technical reason why other colors cannot be added to this range when there is sufficient commercial demand to justify their manufacture.

Saran is usually extruded as a fairly course monofilament. In this form it is made commercially in a wide range of spun-dyed colors. Production of a Saran carpet staple has commenced recently and this type is available in a limited range of colors.

As with Saran, polyethylene is usually extruded as a monofilament. It is available in a limited range of spun-dyed colors.

PIGMENT REQUIREMENTS FOR MAN-MADE SPUN-DYED FIBERS———There are a number of basic requirements for pigments to be incorporated in the spinning dope of man-made fibers which are common to the whole group. These are:

a) *Particle Size* should not exceed 1 micron and preferably should be within the range between 0.1 and 0.25 micron. Coursely dispersed pigments usually produce an undesirable dulling of the color. The surface color of many dyes is different from the transparent color. This becomes increasingly evident with increasing particle size. It has already been mentioned that coarse particles of pigment incorporated into the spinning dope will clog filters and spinning jets.

b) *Shape* or crystal structure has a pronounced effect on the color of a pigment. Small variations in pigment-manufacturing technique can cause variations in shape of the finished product. It would appear that the ideal particle shape is spherical.

c) *Color Value.* To be useful in creating a spun-dyed fiber, the pigment must have relatively high tinctorial value in low concentrations (0.5% to 3% on the weight of the fiber substance).

d) *Luster.* The pigment must give a bright lustrous shade in the fiber. It has been pointed out by Jones (*12*) that the degree of dispersion of pigments influences both color and luster. "Improved dispersions always change these colors as follows: blues go cleaner, brighter and greener; greens go yellower and cleaner; yellows go lighter and cleaner; reds go yellower and stronger."

**TABLE II**
**Typical Organic Pigments**

a) *Nitro Compounds*
- Pigment Chlorine GG (*CI* 13)
- Lithol Fast Yellow GG (*CI* 14)

b) *Azo Compounds*
- i) Naphthol Type—
  - Toluidine Red R (*CI* 69)
- ii) Naphthol AS Type—
  - Permanent Red FRLL (Pr 541)
- iii) Acetoacetic Ester Arylamide Type—
  - Hansa Yellow G (Pr 103)
- iv) Pyrazolone Type—
  - Pigment Chrome Yellow L (*CI* 638)

c) *Anthraquinone Compounds*
- Algol Pink R (*CI* 1128)
- Indanthrene Blue RS (*CI* 1106)

d) *Indigoid Type*
- Indigo (*CI* 1177)
- Indanthrene Red Violet RH (Pr 503)

e) *Phthalocyanine Type*
- Monastral Fast Blue BS (Pr 481)
- Phthalocyanine Green (Pr 482)

e) *Effect on Fiber Properties.* The pigment must have no appreciable adverse effect on physical properties of the fiber, such as strength, elasticity, surface friction and abrasion resistance, nor should the pigment catalyze photodegradation of the fiber.

f) *Fastness Properties.* The pigments must meet very stringent fastness requirements. Not only must the pigment withstand fiber manufacturing processes involving contact with chemicals such as caustic soda and sulfuric acid solutions in the case of viscose rayon, solvents such as acetone in the case of cellulose acetate, high temperatures in the melt spinning of nylon and Terylene (Dacron in the USA); but also it must show outstanding fastness characteristics in fabric manufacture and the end uses to which the fabrics are applied. In fabric manufacture, the pigment may come in contact with stripping or bleaching agents. In their end-uses, the pigmented fibers must possess a high degree of fastness to sunlight, various types of washing and dry-cleaning, perspiration, weathering, sea and chlorinated water.

PIGMENTS EMPLOYED IN THE MANUFACTURE OF MAN-MADE SPUN-DYED FIBERS———Detailed descriptions of typical synthetic pigment colors and their fastness properties are already available in the literature (*12, 13, 14*). Table II shows chemical formula and color of a few typical synthetic pigments which may be used in the manufacture of man-made spun-dyed fibers, classified as to chemical type.

In the case of organic pigments, a distinction must be made between true pigments (ie, colored compounds which intrinsically possess the required insolubility), and so-called lakes and toners. The latter are obtained by the precipitation of water-soluble dyes by means of inorganic salts. Lakes are precipitated in the same manner, except that they are deposited on a white substrate (eg, aluminium hydroxide).

METHODS FOR INCORPORATION OF PIGMENTS INTO THE SPINNING DOPE———Three conventional methods for addition of pigments to man-made fiber spinning dope are given below. Implicit in all three methods are the pigment requirements given previously.

a) *Mass Coloration.* The pigment dispersion is added directly to the mixer in which the spinning dope is prepared. Thus, the whole mass of the dope is colored; it is then spun into fiber or yarn in the normal manner. Advantages of the process are that extremely even shades are obtained on long runs and no additional equipment is required. Disadvantage is the relatively high cost of cleaning the equipment involved. The method is practical only when a single line of equipment is available for each color and when there is a commercial demand for the full production from all the lines.

b) *High Concentration Injection.* In this process a high concentration of pigment is incorporated into a relatively small batch of spinning dope to form a master batch. This is then injected into the spinning line under constant pressure and flow. The pigmented and unpigmented spinning dope are thoroughly mixed in a homogenizer or other type of mixer at the spinning machine, and then pumped to the spinnerettes. Injection ratios vary between 100 parts of unpigmented dope to 1 part of pigmented dope for pale shades down to 10 to 1 for heavy shades. If the injection ratio is not held precisely, objectionable variation in shade and fiber size results. This method has the advantage of speed and ease of cleaning equipment. It also permits the spinning of short runs. However, capital costs for equipment is high and a sizeable labor load is involved as compared with unpigmented fiber production. In the manufacture of spun-dyed fibers, this is the most widely used process today.

c) *Direct Injection.* The pigment in suitable form, is injected through a mixer directly into the spinning dope at the spinnerette or at the spinning solution pump feed line. The main advantage of this process is the elimination of master batch preparation. Its disadvantages are the diffi-

**TABLE III**
**Fastness test results on spun-dyed viscose filament yarn**

| | Yellow | | Green | | Blue | | Grey | | Beige | | Red | | Brown | | Black | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $SC_1$ | $St_2$ | SC | St | SC | St | SC | St | SC | St | SC | St | SC | St | SC | St |
| Colorfastness to | | | | | | | | | | | | | | | | |
| Washing at 160° F | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Washing at 182° F | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Perspiration | | | | | | | | | | | | | | | | |
| Acid | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Alkali | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Crocking | | 5 | 5 | 5 | 5 | 5–4 | 5 | 5 | 5 | 5 | 5 | 5–4 | 5 | 5–4 | 5 | 5 |
| Dry | 5 | | | | | | | | | | | | | | | |
| Wet | 5 | 5–4 | 5 | 5–4 | 5 | 5–4 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5–4 | 5 | 3–4 |
| Drycleaning | | | | | | | | | | | | | | | | |
| Stoddard solvent | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5–4 | 5 | 5–4 | 5 | 5 | 5 |
| Perchlorethylene | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5–4 | 5 | 5–4 | 5 | 5 | 5 |
| Bleaching | | | | | | | | | | | | | | | | |
| Alkaline hypochlorite | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Acid hypochlorite | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Peroxide at 50° C | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Peroxide at 88° C | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Soda boiling | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5–4 | 5 | 5–4 | 5 | 5 |
| Chlorinated water | 5 | 5 | 5 | 5 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Sea water | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Cross dyeing | | | | | | | | | | | | | | | | |
| Sulfuric acid | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Sulfuric acid—chrome | 5 | 5 | 5 | 5 | 5 | 3–2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Vat dyeing | 5 | 4 | 3 | 5–4 | 5–4 | 3–2 | 5 | 5 | 5 | 4 | 5 | 5 | 4–3 | 2 | 5 | 5 |
| Carrier technique | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Scouring with woo | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Degumming | 5 | 5 | 5 | 5 | 5 | 5–4 | 5 | 5 | 5 | 5 | 5 | 4–3 | 5 | 4–3 | 5 | 5 |
| Milling | | | | | | | | | | | | | | | | |
| Acid | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Alkaline | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Light | | | | | | | | | | | | | | | | |
| Fade-Ometer | 8* | | 7 | | 8* | | 8* | | 7–8 | | 8 | | 8* | | 8* | 8* |
| Daylight under glass | 8* | | 8 | | 8* | | 8* | | 8 | | 8* | | 8* | | 8* | 8* |

[1]shade change
[2]staining
*The colorfastness of the shade exceeds that of AATCC Lightfastness Standard L8

**TABLE IV**
**Fastness test results on spun-dyed acetate filament yarn**

| | Yellow | Green | Blue | Navy | Green-Gold | Red | Maroon | Black |
|---|---|---|---|---|---|---|---|---|
| Colorfastness to | | | | | | | | |
| Washing at 105° F (#1) | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Washing at 180° F (#4) | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Perspiration | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Pressing | | | | | | | | |
| Dry | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Wet | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Crocking | | | | | | | | |
| Dry | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Wet | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Drycleaning (wet) | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Bleaching (sodium chlorite/acetic acid) | 5 | 4 | 4 | 5 | 3 | 4 | 5 | 5 |
| Sodium hydrosulfite (Alkaline pH) | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 |
| Stripping (zinc sulfoxform & formic acid) | 5 | 5 | 5 | 5 | 4 | 3 | 5 | 5 |
| Sea water | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Pressing | | | | | | | | |
| Dry | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Wet | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Gas-fading cycles | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Sublimation | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Light (Fade-Ometer) | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 8 |

**TABLE V**
**Fastness test results on spun-dyed black Orlon and nylon**

| | Orlon (Type 81) | Nylon |
|---|---|---|
| Color fastness to washing at 160° F (#3A) | 5 | 5 |
| Bleaching in sodium hypochlorite (#3-55) | — | 5 |
| Fume fading (#23-54) | — | 5 |
| Crocking—Dry | 5 | 5 |
| (#8-52) —Wet | 5 | 5 |
| Perspiration, acid & alkaline | 5 | — |
| Drycleaning, dry and dry & wet | 5 | — |
| Sublimation (300° F, 2 min) | 5 | — |
| Carbonizing | 5 | — |
| Heat setting @ 450-475° F | — | no yellowing |
| Light—Fade-Ometer | 8* | 8 |

*The color fastness of the shade exceeds that of AATCC Light Fastness Standard L8.

culty in maintaining evenness of shade from fiber to fiber and the need for a large number of highly efficient mixing machines.

COLOR FASTNESS CHARACTERISTICS OF SPUN-DYED FIBERS——The most outstanding fastness properties of all spun-dyed fibers are resistance to fading by sunlight, and washfastness. In these properties, they excel fibers, dyed by the fastest known conventional dyeing techniques. Certain spun-dyed colors are available commercially today which will withstand 500 hours of tropical sunlight without a color break. Even the AATCC scale of light fastness, with a maximum standard of L8, does not provide for this degree of fastness.

In Tables III, IV, and V are shown fastness properties of typical commercial spun-dyed viscose, acetate, Orlon and nylon fibers. The various fastness tests mentioned in the tables have all been carried out by standard AATCC test methods when available. The result of the tests are expressed in standard AATCC ratings. A rating of 5 is the highest for all properties except fastness to light for which 8 indicates the top level. One has only to compare these results with similar test results on any fiber dyed by the conventional wet-dyeing techniques to see that spun-dyed fibers provide a unique plateau of fastness properties, hitherto unattainable in the textile industry by any known means.

To return to the first part of this paper, a sample of the silk fabric dyed with early vintage Perkin Mauve was exposed to artificial sunlight in the Fade-Ometer. After four (4) standard hours exposure a color break occurred, resulting in AATCC rating of L2. Thus since the first synthetic dye produced one hundred years ago, through the tremendous improvement in fastness to light of newer dyes, and pigments in particular, lightfastness not dreamed of

at that time is now a reality. A sample of cellulose acetate filament yarn spun-dyed with pigments to give a Perkin Mauve color has withstood 120 standard Fade-Ometer hours (L6) before giving a color break, an improvement of thirty fold over the Perkin original.

POTENTIAL AND FUTURE OF SPUN-DYED FIBERS——Commercial production of man-made spun-dyed fibers in appreciable quantity dates from the end of World War II, a span of only 10 years. While no actual figures are available in regard to world production of spun-dyed fibers, today it is sizeable. There has been a rapid surge in production in the last five years for both filament yarn and staple fiber of this type.

The outstanding contributions of spun-dyed fibers to improved textile technology are in the fields of fastness to sunlight, to washing, to perspiration, sea water, and so on. They allow the textile industry to provide a degree of fastness not available previously. For this reason, the automotive industry has shown a great deal of interest in spun-dyed fibers. This type of fiber, in due course, very likely will become a major factor in the bathing suits, sports wear, carpet, house furnishings, awnings and other sectors of the textile industry.

Other contributions made by spun-dyed fibers are an amazing uniformity of shade from lot to lot of filament yarn or staple fiber, because of the precision controlled conditions under which they are produced. In addition, the color is much more evenly distributed through the fiber than is obtained under the most favorable wet-dyeing technique for color application. This is illustrated by a series of seven microphographs of spun-dyed viscose and acetate fibers. Also, by the use of spun-dyed fibers, any strength losses which may be associated with conventional wet dyeing are eliminated

Spun-dyed fibers, in whatever fabric end uses may be involved, completely remove the grief and disappointment of staining or bleeding which occurs on occasion with conventionally dyed fabrics. It is possible that laundries will not have to sort into nearly so many groups when dealing with fabrics made from spun-dyed fibers. Indeed, there is no reason why spun-dyed goods can not be thrown in with white goods by the launderer. His claim problems will also be reduced materially.

The range of colors produced in spun-dyed, filament yarn and staple fiber will increase as this industry grows. Most fiber manufacturers in the field today supply a range of between 8 and 30 colors. However, one British firm has 60 colors available in filament yarn. Flexibility in color range is available in the case of staple fiber, through the blending of two or more colors to produce a color blend in yarn and fabric.

It is conceivable that, in the future, man-made fiber producers may supply "tailor-made" colors to the customer. However, this will probably involve new ideas in manufacturing equipment and heavy capital costs. The economics of such a venture would have to be examined very closely.

If Sir William Henry Perkin were with us today he would perhaps be somewhat amazed to learn of a whole host of commercial man-made fibers, in natural and spun-dyed colors, unknown a century ago. He probably also would be pleased to learn that more than three thousand synthetic dyes are available today from an industry which now produces some five hundred million pounds a year.

## ACKNOWLEDGMENTS

The authors wish to express sincere thanks to all those companies and persons who assisted in the preparation of this paper. In particular, they are grateful to Dr R V V Nicholls of McGill University, Dr C B Stevens of Leeds University, Canadian Celanese Limited, Courtaulds Limited, Courtaulds (Canada) Limited, Interchemical Corporation, Sandoz (Canada) Limited, Unicolor Limited, and Union Carbide and Carbon Corporation.

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# AATCC Calendar

**COUNCIL**

Mar 29 (Roanoke, Va); June 7 (New York)

**NATIONAL CONVENTIONS**

Nov 14-16, 1957 (Hotel Statler, Boston); 1958 (Hotel Conrad Hilton, Chicago); 1959 (Sheraton Park and Shoreham Hotels, Washington, D C); 1960 (Philadelphia, Pa); 1961 (Buffalo, NY)

**HUDSON-MOHAWK SECTION**

Mar 29 (Johnstown, NY); May 17 (Ladies Nite—Schuyler Meadows, Albany, NY); June 21 (Outing—Antlers Country Club, Amsterdam, NY)

**NEW YORK SECTION**

Mar 1 (Hotel Delmonico, New York, NY); Apr 26, May 24—ladies nite (Kohler's Swiss Chalet, Rochelle Park, NJ); June (Annual Outing)

**NIAGARA FRONTIER SECTION**

Mar 15 (Buffalo, NY); Apr 5 (Joint meeting with CATCC at Kitchener, Ont)

**NORTHERN NEW ENGLAND SECTION**

Mar 1 (Hotel Vendome, Boston, Mass); May 3 (Lowell Tech Inst, Lowell Mass); Sept 13 (Outing —Wachusett Country Club, W Bolyston, Mass); Dec 6 (Annual meeting, Hotel Continental, Cambridge, Mass)

**PIEDMONT SECTION**

Mar 30 (Hotel Roanoke, Roanoke, Va); June 7-9 (Outing—Mayview Manor, Blowing Rock, NC); Sept 28 (Hotel Barringer, Charlotte, NC)

**SOUTH CENTRAL SECTION**

Apr 27 (Hotel Patton, Chattanooga, Tenn); June 21-22 (Outing—Lookout Mtn, Tenn); Sept 20 (Hotel Patton)

**SOUTHEASTERN SECTION**

Apr 13 (Legion Hall, Lindale, Ga); June 7-9 (Outing—Radium Springs, Ga); Sept 14 (Harmony Club, Columbus, Ga); Dec 7 (Dinkler Plaza Hotel, Atlanta, Ga)

**RHODE ISLAND SECTION**

Mar 28 (Providence Engineering Society, Providence, RI); Apr 25 (Student Night—New Bedford ITT, New Bedford, Mass); June 14 (Outing—Warwick CC and Rocky Point, RI); Sept 27 (Ladies Night—Narragansett Hotel, Providence, RI); Oct 24 (Prov Eng Soc) Dec 5 (Annual Meeting—Johnson's Hummocks Grill, Providence, RI)

**WESTERN NEW ENGLAND SECTION**

Mar 15 (Rapp's Restaurant, Shelton, Conn); May 17 (Ladies Night—Waverly Inn, Cheshire, Conn); June 14 (Outing—Wallingford, Conn); Sept 27 (Rapp's); Nov 1 (Annual meeting—Hartford area); Dec 13 (Rapp's)

Perkin Centennial———

# AMERICA'S DEBT TO PERKIN*

SAMUEL LENHER
*E I du Pont de Nemours & Co, Inc*
*Wilmington, Del*

WHEN William Shakespeare wrote "The evil that men do lives after them, the good is oft interred with their bones," he turned out a couplet of high literary merit, but of dubious value as a guide to life. So far from validating the Bard's somewhat pessimistic evaluation of the longevity of man's good works, the experience of industry, and especially the chemical industry, would seem to me to furnish a vigorous and effective rebuttal.

Nowhere is this more true than in the life of William Henry Perkin, and in his good works, the centenary of one of which we are this week celebrating. Not only has the good done by Sir William lived after him; it has proliferated and spread until its effects are felt throughout the civilized world.

It is altogether fitting that this particular piece of good, the discovery of the first coal-tar dye, should be marked by appropriate ceremonies, and as a representative of and spokesman for both the Manufacturing Chemists' Association and the Synthetic Organic Chemical Manufacturers Association, I am honored by the opportunity to take part in them.

Had Perkin's career ended when, in an unsuccessful effort to synthesize quinine, he made aniline purple, or mauve, his contribution to chemical science would have been important. For the breach in the wall limiting human knowledge made by this discovery led to the opening up of an entire new field of knowledge, a field which contained incalculable good for mankind, and a field which has certainly not been completely explored even yet.

Here, we can say with more certainty than often attends such pronouncements, was the birth of the coal-tar color industry. The experiments were remarkable enough because they were done in an improvised laboratory by an 18-year-old youth during the Easter vacation of 1856. And, technology being what it is, you do not create an entire industry overnight by a development of this kind. You start a chain reaction that, as I indicated a moment ago, spreads until it permeates and affects the whole civilized world.

It will not, I trust, be taken as indicating a mercenary attitude on my part when I say I wish I knew exactly what Perkin's work meant to him in pounds, shillings and pence. It is not a mercenary desire because I should like to obtain and match it against another figure, also in terms of currency. That figure is the total wealth created up to now, not for Perkin, but for men and women all over the world, by what he did.

I recognize there are many things we cannot measure in terms of dollars. I recognize that we cannot weigh at all the contributions to human health, comfort, and well-being, the added security, the countless employment opportunities, of a development such as Perkin's. Yet those two figures, for want of better, would give us a bench-mark. And the enormous disparity would, once and for all, refute Master Shakespeare's mournful appraisal.

As I have indicated, the birth of the coal-tar color industry was only the beginning. Perkin's new dye, and the host of other coal-tar colors that were soon to follow, led to a demand for aniline and other coal-tar derivatives which in 1856 were only laboratory reagents. This demand brought about a revolution in the coal-tar industry itself, with the result that many coal-tar chemicals—some hitherto unknown—were soon available.

Also, the inorganic chemicals industry as it existed 100 years ago was greatly benefited by Sir William's discovery. Production of aniline from benzol via nitrobenzol, a process, incidentally, devised by Perkin, necessitated large quantities of sulfuric and nitric acids for nitrating the benzol, and the greatly increased demand for sulfuric acid led to the development of the contact process for the manufacturer of this indispensable chemical—in itself a revolutionary development.

Because of their uniform quality and price, and the variety of colors in which they were soon available, synthetic dyes also provided a great impetus, and increased stability, to existing color-consuming industries—textiles, paper, and leather in particular.

As pointed out by Perkin, the coal-tar color industry had its origin in scientific research. And, as if to repay its indebtedness to the research from which it sprung, the coal-tar color industry gave a fresh impulse to laboratory investigations by suggesting new problems and providing new products with which to work. It was, in fact, through research with the new and versatile organic chemicals provided by the dye and coal-tar industries that America's modern synthetic organic chemicals industry came into existence.

For the dye industry which he created, and for the influence which this industry has had upon other lines of manufacture, especially our modern synthetic organic chemicals industry, we in America are greatly indebted to Perkin. I say this because today the industries which owe their existence—wholly or in part—to Perkin's discovery of mauve 100 years ago provide employment at good wages for many thousands of American men and women, and turn out each year products valued in the billions of dollars. Mention should also be made of the varied and strategic uses which have been found for the thousands of products made by our domestic dye and synthetic organic chemicals industries. Included among the numerous progeny of these industries are such important, and in some cases virtually indispensable, products as insecticides, weed killers, and seed disinfectants; commercial and military explosives; synthetic rubbers and chemicals to speed the processing of rubber and prolong its useful life; synthetic perfume chemicals; photographic chemicals; synthetic resins for fast-drying, durable, finishes; and last, but by no

*Presented by Mr Lenher on Thursday, September 1956, as representative of and spokesman for the Manufacturing Chemists' Association, Inc and the Synthetic Organic Chemical Manufacturers Association of the United States, on the occasion of The Perkin Centennial Commemorating the Discovery of Aniline Dyes at the Waldorf Astoria, New York, NY.

means least, antiseptics, anesthetics, and drugs for healing of disease.

Before discussing further our debt to Perkin, however, I should like to review briefly a few of the facts surrounding the early life of this truly remarkable man. Part of what I shall have to say in this connection is based on the address of Sir William at a banquet in his honor here in New York on October 6, 1906, marking the Golden Jubilee of his discovery of mauve, at which time he received the first Perkin Medal.

Perkin's father was a builder who hoped his son might become an architect, but when William was between 12 and 13 years old, a friend showed him some chemical experiments, including, in the words of Perkin himself many years later, "the wonderful power of substances to crystallize in definite forms." The latter, especially, he said, "struck me very much, with the result that I saw there was in chemistry something far beyond the other pursuits with which I had previously been occupied," having reference to some preliminary explorations on the part of young Perkin in the fields of mechanics, drawing, and oil painting. Sir William went on to say, "The possibility also of making new discoveries impressed me very much." Perhaps the circumstances which led this talented youngster to choose chemistry as his life work provide a lesson for those of us who are currently interested in the technical manpower shortage!

So at the age of 13 William entered the City of London School, where lectures on chemistry and natural philosophy were given twice a week by Thomas Hall. Because of his great interest in science he was soon made an assistant to Hall, one of his principal duties being to set up apparatus for the experiments and assist at the lectures, which, incidentally, were given at the noon recess. Here was a boy who, in all truth, would rather hear a lecture on chemistry than eat, for young William gladly went without lunch to listen to, and help out with, these noon-hour lectures.

Perkin's father was quite disappointed over the boy's choice of a profession, since the outlook for chemists did not appear promising at that time. The boy was, however, allowed to follow his bent, and at the age of 15 left the City of London School and entered the Royal College of Chemistry, likewise in London, where the brilliant German chemist, August Wilhelm Hofmann, was a professor. In the words of the late Edwin E Slosson, Hofmann obviously had no fear of "forcing the young intellect prematurely. He perhaps had never heard that the tender petals of the adolescent mind must be allowed to open slowly."

Here young Perkin pursued the then conventional courses in chemistry, and at the age of 17 became an assistant to Hofmann and was permitted to carry out research on his own account.

How fortunate for Perkin and for the world that Hofmann was a chemist rather than a pedagogical psychologist; else, again quoting Dr Slosson, "he would have been informed that nothing chills the ardor of the adolescent mind like being set at tasks too great for its powers."

So the youthful Perkin was allowed —even encouraged—to pursue research problems that today would be regarded as far beyond the ken of teen-age boys. And perhaps there is an important lesson to be learned from Sir William's early training. I realize that not every youngster should be permitted to choose his life work at the age of 13, and that few 17-year-old boys are capable of carrying out worth-while chemical research on problems of their own choosing. I do feel, however, that if our colleges and universities are to supply this country with the thousands of highly trained scientists and engineers that we must have each year, if we are to maintain our present standard of living and our high level of industrial efficiency, and if the national security is to be safeguarded, some way must be devised to uncover our talented boys and girls before they lose their youthful ardor. Also, steps must be taken to insure that nothing stands in the way of their receiving academic training commensurate with their mental ability.

In America much attention is given in our schools to mentally retarded pupils—and rightly so. Large amounts of money are allocated to their training and I would favor the spending of whatever sums of money are necessary to make sure that these unfortunate children get all the education they are capable of receiving. I regret to say, however, that in the average classroom, the gifted child is generally neglected. If we are to avoid developing a cult of mediocrity, our school administrators must see to it that special classes are provided for the gifted as well as for the subnormal child.

As Hofmann's assistant, so much of Perkin's time was devoted to the master's own research problems that he had very little opportunity at school to carry out research on his own account. This was why the youngster set up a rough laboratory in his father's home, in which he discovered aniline purple while trying to synthesize quinine—a problem, incidentally, of his own choosing.

And here I should like to digress for a moment. Perkin's synthesis of mauve has frequently been referred to as a lucky "accident"—a word which to me is distasteful in that it connotes that the so-called accident might have happened to, and been used to advantage by, just anyone. I think Pasteur expressed it well when he said, "Chance favors the mind that is prepared," and Perkin's mind was certainly prepared. For as expressed by Dr Hugo Schweitzer at the Perkin Golden Jubilee in 1906, "It was truly the spark of genius which led Perkin to investigate the dyeing properties of that dark-colored precipitate which would have been cast away by any other scientist of that period, and particularly by his master, Hofmann, who objected to experimenting with anything that did not crystallize and who had at that time a strong aversion to working with substances which were colored."

While I have no desire to become bogged down in the field of semantics, I would much prefer to speak of the synthesis of mauve as a good illustration of "serendipity," making use of a word coined by Horace Walpole more than 200 years ago. In a letter to his friend Horace Mann, Mr Walpole alluded to a fairy tale about three princes of Serendip—an old name for Ceylon—who, in the course of their travels, were always making discoveries of things they were not in search of. But please note that the Serendip princes, like Perkin, were in search of something. A mere traveler, having neither curiosity nor wisdom, might stumble purely by accident upon a fortune in gold and jewels carelessly hidden by a buccaneer of bygone days, but if young William Henry Perkin had not possessed more than his share of curiosity and wisdom, the dark-colored precipitate which he discovered would have been thrown into the sink. Perhaps he was led to try to dye silk with this hitherto unknown colored material because of the inspired curiosity which is characteristic of great scientists and great inventors.

Perkin dropped out of school shortly after his discovery of mauve, very much against the will of Professor Hofmann, and with the aid

of his brother and the financial backing of his father who risked his life savings on the dreams of a teen-age boy, launched the synthetic dye industry in a plant at Greenford Green, near Harrow, which within a few decades was to bring about an industrial revolution.

Perkin himself felt considerable trepidation over this new venture, being fearful, as he said, "that by entering into this technical pursuit my research work might be prevented, but I determined that so far as in me lay, this should not be the case." And, as many of you know, it was not the case, for Perkin was yet to do much research that was of interest both academically and industrially.

With such speed did the Perkins move that aniline purple was in commercial production for silk dyeing by December of the following year —1857. But, as is well known to industrial men, it is one thing to manufacture a new product and another to sell it; so in order to find customers for the new color he had discovered, it was necessary for Perkin to visit dyeworks and show the dyers how to use it. He thus initiated a practice that was as new as mauve; namely, technical service to customers, which today is an outstanding feature of the chemical industry.

It appears, however, that Perkin was a good salesman as well as a good chemist, with the result that mauve was soon the talk of England. Even Queen Victoria, while in mourning for her consort, Prince Albert, wore a dress dyed with the new color, and the British government issued several mauve postage stamps. Immortality of the new color was insured by the era known as the "Mauve Decade," and even the London bobbies made their contribution with a pun on the word, telling loiterers to "Get a mauve on!"

Although England was presented with the synthetic dye industry on a silver platter, as it were, it was Germany that quickly attained supremacy in the field of dyes and other synthetic organic chemicals. If one is to take the word of Sir William regarding this anomalous situation, there were two reasons why it was Germany, rather than England, that "ran with the ball." First, Germany enjoyed a superiority over England in respect to technical manpower, and second, British dye manufacturers did not have the tariff protection which this new industry needed and which, incidentally, our American dye industry was fortunate enough to enjoy during its infancy—thanks to the campaign waged by US dye manufacturers over a period of years, and the wise and friendly attitude of the government.

Within a few years after the end of the Franco-Prussian War, German competition became serious, and Perkin was not willing to make the added investment to his business that would have been needed in order to meet this ever-growing competition. Also, he had made the 100,000 pounds sterling which was said to be the goal of most English businessmen in those days, and, since chemical research was his first love, he sold his plant in 1873 after an industrial career of only 17 years—at the early age of 35. The remainder of his long and useful life was devoted to research, some connected with dyes, but chiefly with other subjects, including fundamental investigations in various fields.

German supremacy in the field of dyes was, as is well known, to last until World War I, at which time we in America woke up to a full realization of our sad plight. The story of our almost complete dependence upon Germany for dyes, drugs, and other vital coal-tar chemicals has been told so many times that I shall not repeat it here. Suffice it to say that during the period between the close of World War I and the outbreak of World War II, this country achieved complete independence in the field of dyes, and today America has a dye industry that is unsurpassed. Our colors are the equal of any produced in the world, and our industry no longer follows, but leads.

Getting our domestic dye industry on a firm footing was not, however, an easy job. For one thing, men having the desired technical training were in short supply, as evidenced by the fact that in 1914 the number of PhD's in chemistry turned out by American universities was only 71. Thanks in part to the great impetus given research by the rapidly growing dve and synthetic organic chemicals industrv, this figure had risen to 250 by 1925. Last year, the number was upwards of 1000.

As suggested above, chemical independence was not to be had for the asking. In the all-out fight to achieve self-sufficiency in the field of dyes and other synthetic organic chemicals, it was necessary for American chemical manufacturers to risk many millions of dollars with little or no assurance of ultimate profits. And it should be made clear that this was true not merely of one or two companies, but of all those that ventured forth into this hitherto uncharted sea. Accurate over-all industry figures are not available, but I do know that in building up its own dye and organic chemicals business, the company with which I am associated sustained a net loss of approximately $17,000,000 from 1917 to 1922. And it was not until 18 years after inception of the venture —and after $43,000,000 had been risked—that aggregate earnings offset accumulated losses. In speaking of this trying period some years later, Lammot du Pont, who served as president of our company from 1926 to 1940, gave utterance to one of the understatements of all time when he said: "We kept risking money. When everything you make costs more than you can sell it for, you are apt to become discouraged."

And I should like to repeat that comparable risks were taken by other companies—both large and small—in the struggle for chemical independence.

Despite the fact that dyes are now used for literally hundreds of purposes, production figures for America's dye industry are not particularly impressive; and this is especially true in comparison with production figures for steel, copper, plastics, synthetic rubber, or man-made fibers. The reason is, of course, that a little dye goes a long way. For example, the colors in a man's suit, shirt, socks, hat, and necktie cost, on the average, under 30 cents. Assuming that his complete outfit cost $100, the dyes used represent less than half of one per cent of the total. And it is scarcely necessary to say that the dyes in women's apparel—due to the difference in weight—cost only about half as much as those for a man's. The dyes in sheer hosiery and dainty lingerie, for example cost only a cent or two, while those in a dress or suit might run to as much as a nickel.

Thus it was that in 1954, the latest year for which accurate figures are available, when US manufacturers not only made all the dyes we needed but also had a considerable export balance, America's production of dyes amounted to only 142,982,000 pounds—less than one pound for each man, woman, and child in this country. Possibly more amazing is the fact that the average price of the dyes sold that year by American manufacturers was only $1.17 a pound—about the cost of a reason-

ably good cut of beefsteak.

Even to one who has been in the dye business for a good many years, such a price figure is amazing, particularly when one considers the good wages paid to American chemical workers, and the fact that dyes are made in relatively small batches. When only a few thousand pounds of a product may be made in a year, as in the case of certain dyes, it is obvious that production does not lend itself to the continuous, stream-lined operations used in the steel and automobile industries or in the manufacture of heavy chemicals such as sulfuric acid.

In fact, so small is the domestic output of dyes that some academic economists have asked what harm would result if all tariff barriers were removed, permitting the unrestricted flow into this country of colors from abroad, made by workers whose wages are only a fraction of those paid in America. In spite of our industrial efficiency, we could not, of course, meet this foreign competition and American dye manufacturers would have to go out of business. But, ask these academicians, would this do any serious harm, considering the fact that dyes constitute such a small percentage of America's total chemicals business?

The answer is simple. If, by losing our dye business, that were *all* that we lost, perhaps no very serious harm would be done were the flood gates opened and a torrent of foreign dyes permitted to flood the US market. But the value to America of her dye business far transcends the monetary value of 140-odd million pounds of dyes.

In comparison with the value of our other chemicals and related products, the $160,000,000, more or less, that we get for our dyes is admittedly a small figure, and is indeed picayune in comparison with the irreparable losses we would suffer otherwise. For as previously suggested, the American dye industry is a *key* industry. It not only launched the coal-tar chemicals industry and gave impetus to the various color-consuming industries—this industry for which we are indebted to Perkin was also the forerunner of America's vast synthetic organic chemicals industry which annually turns out some four billion dollars worth of products and provides employment for upwards of 300,000 men and women; and, through the use of vast quantities of such inorganic materials as sulfuric, hydrochloric, and nitric acids, soda ash and caustic soda, ammonia, and chloride, the American dye industry also contributed importantly to the growth of our inorganic chemicals industry.

We have seen also how the dye industry stimulated higher education in chemistry and related fields, since America's rapidly expanding chemical industry demanded well-trained chemists.

Further, the American dye industry, which traces its lineage to the research of an 18-year-old British lad just a century ago, provides this country with a nucleus of highly trained men and women who because of their training, versatility, and broad chemical experience, would be well-nigh indispensable to our country's security in the event of a national emergency. This is not to suggest that a dye chemist is a unique sort of creature. Much the same could be said for chemists in certain other fields which demand highly trained men, but it is the dye industry with which we are presently concerned.

But perhaps of greater importance than any of the foregoing are the wide, varied, and strategic uses which have been found for dyes and the thousands of dye intermediates and other complex, synthetic chemicals being made by America's modern synthetic organic chemicals industry—chemicals once derived exclusively from coal tar, but in many cases now derived from petroleum also.

Included among the numerous offspring of this industry are such important, and in some cases virtually indispensable, products as DDT, methoxychlor, and other chemicals for the control of mosquitoes, flies, and other disease-bearing insects; synthetic elastomers, such as the new polyurethane rubbers based on organic diisocyanates which in turn are derived from aromatic diamines formerly used only as dye intermediates; peptizers to speed up the processing of rubber, accelerators to hasten its vulcanization, and antioxidants to prolong its useful life; commercial and military explosives; synthetic resins for fast drying, durable finishes; photographic chemicals; synthetic perfume chemicals, including the artificial musks and some, like lily-of-the-valley odor, which are too delicate to survive extraction from the flower; selective weed killers such as 2,4-D, which behave like the murderous Mr Hyde on broad-leaf plants, but like the saintly Dr Jekyll on the narrow-leaf lawn grasses; chemicals like certain of the substituted urea herbicides which serve not only as pre-emergent weed killers in cultivated crops, but, when used at higher rates, will sterilize the soil around oil tanks and keep railroad rights-of-way free of unwanted vegetation for long periods of time; seed disinfectants to destroy the fungi which frequently kill or seriously injure the delicate seedlings of cotton, corn, etc, thereby reducing yields; nonnutritive sweeteners such as saccharine, and the more recent cyclamates which are sufficiently stable to stand up under the heat incident to ordinary cooking; and last, but by no means least, antiseptics, anesthetics, and drugs for the healing of disease.

In view of the importance of health, both to the individual and to the nation, we are particularly indebted to Perkin, and the industries he helped create, for the hundreds of life-saving drugs which are based on dye intermediates and other synthetic organic chemicals.

Special mention should be made of the sulfa drugs, first studied by German, French, and British scientists, which confirmed the dreams of those microbe hunters who had long cherished the hope that "magic bullets"—in the form of synthetic organic chemicals—might be discovered for the control of bacterial diseases which formerly exacted a toll of countless thousands of lives each year.

Pioneer American workers in sulfonamide therapy were Drs Perrin H Long and Eleanor Bliss of The Johns Hopkins University. Using sulfanilamide provided in part by an American dye laboratory, they confirmed certain of the results obtained by Europe investigators, and further demonstrated the life-saving properties of this dye intermediate in the treatment of erysipelas, childbed fever, and other maladies caused by the deadly streptococcus organism.

Sulfanilamide was, of course, only the forerunner of dozens of other life-saving sulfonamides, and the search for more effective sulfas is still under way.

In the meantime a wholly new class of healing agents, the antibiotics, has been developed, including such well-known drugs as penicillin, Aureomycin, Terramycin, Chloromycetin, and streptomycin. Originally derived from natural sources such as soil-borne fungi, certain of the antibiotics have been synthesized in the laboratory, and at least one, Chloromycetin, is now being produced chemically by a process making

use of p-nitrobenzoic acid, a dye intermediate.

Included among other important drugs and pharmaceuticals based on dye intermediates or other synthetic organic chemicals are improved antiseptics; safe and effective sedatives and pain killers; antihistamines for the control of hay fever and other allergic conditions; non-habit-forming anesthetics, both local and general; antimalarials; fungicides for the control of various skin infections; and drugs which have proved effective in the treatment of the age-old disease of leprosy.

Mention should also be made of dietary supplements, such as synthetic vitamins and synthetic amino acids—nature's own building blocks. A recent pharmaceutical development that has attracted considerable attention is the tranquilizing drug chlorpromazine, use of which has made it possible for many suffering from certain serious mental disorders to return home, go back to work, or become amenable to conventional psychotherapeutic treatment. In fact, this new chemical, derived in part from a dye intermediate, may prove as great a boon to those suffering from certain mental disorders as the sulfa drugs and antibiotics to those suffering from bacterial infections.

In spite of the many recent advances in the drug and pharmaceutical field—advances which, since 1900, have helped raise life expectancy in America from 49.2 to 68.8 years, much research must yet be done before cures or preventives are found for all the ills to which mankind is heir. As we are sadly aware, there is as yet no cure even for the common cold. But when we consider all the epochal achievements that have been made during the past generation, is it too much to expect that one of these days "magic bullets" may be found that will bring under control such dread and crippling maladies as cancer, arthritis, multiple sclerosis, muscular dystrophy and various heart disorders? And like sulfanilamide, possibly these long-sought missiles will come from the shelves of a dye laboratory.

Thus we see that the stone which Perkin dropped into the water a century ago set up a series of concentric waves that have touched every land under the sun, "From Greenland's icy mountains to India's coral strand." I am not suggesting that all the good things we in America enjoy came into being as the result of young Perkin's serendipitous discovery of aniline purple back in 1856. For although the dye industry he created has obviously had a far-reaching influence on modern industry and modern living, credit must also be given to our American colleges and universities who trained the thousands of research scientists—both academic and industrial—who have followed in Perkin's footsteps, and to the far-sighted business executives who over the years have allocated countless millions of dollars in support of the research that resulted in many of the good things we Americans enjoy. Credit must also be given to our lawmakers in Washington whose wise and friendly attitude toward America's strategic dye industry, and the synthetic organic chemicals industry which it spawned, has been of inestimable help in developing what is frequently referred to as The American Way of Life. And I make no apology for the use of this cliché—there simply isn't another combination of words that conveys the same meaning.

In his report to Congress for the year 1843, the Commissioner of Patents, Henry Ellsworth, said, "The advancement of the arts from year to year seems to presage the arrival of that period when human improvement must end." Thanks, however, to our colleges and universities, and to the co-operation among the chemists, engineers, physicians, bacteriologists, and other trained men and women they turned out; thanks to those whose grasp on the purse-strings of research has not been too tight; and thanks to a friendly attitude on the part of government, it would seem that the "period when human improvement must end" is still far in the future; and granted a continuation of those factors which have favored our progress in the past, we may look to the future with confidence, for what remains to be done is far greater than anything that has been accomplished in the past.

## Future of Textiles——

*(concluded from page P125)*

We may never be able to turn back the clock—indeed, I doubt if we would want to—and have "the clothes make the man (or the woman)" in the sense that it was once true. At the same time, we cannot stay supinely complacent, saying "this is a pretty dress, or a nice pattern, or a practical finish" while our real competitors, who are every other industry that competes with us for a share of the consumer's dollar, beat our brains out with words and pictures. It is of some significance, I think, that the best-dressed housewife in American advertising is Betty Furness, who sells electrical appliances for Westinghouse.

We must have a campaign to stimulate American women to dress up, to make clothing important to them and to their families and to reestablish apparel as a sign of family status.

We must promote the sale of specific garments and, also, provide a "price stabilizer" for the industry in the promotion of quality merchandise. It should infer indirectly or directly that low-cost merchandise is not as good as higher-priced merchandise. In America, we boast that the cook is as well-dressed as her mistress, that style and fashion have no price tag on our democracy. This, as you know, is only partially true and we must promote this difference.

Our basic problem, the attempt to direct habits and motivations, is not primarily a matter of selling one fabric against another, nor one finish against another. It is to make the consuming public apparel-conscious, drapery-conscious—in a word, textile-conscious as they are already c a r-conscious, television-conscious and fresh-strawberries-in-the-winter-time-conscious.

It might seem that the simple answer would be the direct approach of a cooperative industry effort since the benefits would be industry-wide. In the textile industry, however, which has so fruitfully fostered the individuality of genius—or, perhaps, the genius of individuality—the simple is frequently the eccentric. Complete industry cooperation, founded on a unanimous acceptance of a common interest is a new Japanese import. Yet the need is there and the remedy is patent. If we cannot count on the foresight of leadership, the impatience of ownership may provide the stimulus.

In conclusion, let me say that I realize that there are many unanswered questions, many unfilled gaps in the ideas which I have so sketchily presented. Many of these are necessary because I am not an expert in the implementing of promotional psychology. My purpose was simply to arouse your interest; your questioning and, perhaps, your spirits.

# COMMITTEES OF THE COUNCIL—1957

PERSONNEL of the various committees of the Council were approved as follows at the January 18, 1957 meeting. Those marked * are new members. Others are either specified by the Bylaws, have been appointed previously for specified terms, or have been renominated. Standing Committees are marked (S).

### (S) EXECUTIVE COMMITEEE ON RESEARCH

C W Dorn, *chairman*
C A Sylvester, *vice chairman*
R C Allison, *secretary*

*V B Holland, W A Holst, *J H Jones, R W Jacoby, E W Lawrence, P B Stam, A R Wachter.

### (S) TECHNICAL COMMITTEE ON RESEARCH

C A Sylvester, *chairman*
M J Babey, *vice chairman*
J A Woodruff, *secretary*
H W Stiegler, *director of research*

R C Allison, W D Appel, E C Atwell, C A Baker, K H Barnard, C H Bayley, J R Bonnar, G S Buck, Jr, D G Carmichael, H M Chase, E J Chornyei, H D Clayton, S Converse, W E Coughlin, M A Dahlen, J N Dalton, C W Dorn, C Z Draves, W C Durfee, B F Faris, F Fortess, K R Fox, E Freedman, P J Fynn, A H Gaede, H E Hager, J J Hanlon, M Harris, S L Hayes, A K Haynes, H F Herrmann, A E Hirst, V B Holland, W A Holst, G H Hotte, R W Jacoby, N A Johnson, J H Jones, E R Kaswell, S J Kennedy, J Labarthe, E W Lawrence, H W Leitch, E A Leonard, C W Lever, L S Little, E M Lynch, Jr, A R Macormac, J E Meili, H E Millson, J E Norton, A D Nute, W F Prien, F A Prisley, C N Rabold, F J Rizzo, R E Rupp, B A Ryberg, C H A Schmitt, W M Scott, C A Seibert, F T Simon, G M Smith, R B Smith, T R Smith, R H Souther, P B Stam, J G Stass, R L Stutz, A F Tesi, P Theel, F Tripp, A R Wachter, J F Warner, G S Wham, Jr, H E Wilde, M W Winkler, P J Wood, R K Worner, H L Young, C L Zimmerman.

### (S) PUBLICITY

J A Doyle, *chairman*

Committee to be appointed in cooperation with local Sections.

### (S) APPROPRIATIONS

R E Derby, *chairman*

*R W Jacoby, G P Paine, T R Smith, P J Wood.

### (S) MEMBERSHIP AND LOCAL SECTIONS

W G Helmus, *chairman*

E R Kaswell, E Morrill, G P Paine, H G Smith.

### (S) PUBLICATIONS

W M Scott, *chairman*
N A Johnson, *secretary*

J R Bonnar, W H Cady, J A Doyle, C Z Draves, W A Holst, *W G Helmus, R W Jacoby, H Y Jennings, E R Kaswell, E W Lawrence, P J Luck, *E Morrill, H G Smith, P Theel, C A Whitehead.

### (S) CORPORATE MEMBERSHIP

A E Johnson, *chairman*
*G P Paine, *secretary*
W G Helmus, *vice chairman*
E Morrill, *vice chairman*
E R Kaswell, *vice chairman*
H G Smith, *vice chairman*

(Vice presidents are vice chairmen of the Corporate Membership Committee, Article III, Section 3, Bylaws.) Committee to be nominated by chairman in cooperation with Sections.

### (S) CONSTITUTION AND BYLAWS

W A Holst, *chairman*

E R Kaswell, P Theel.

### (S) CONVENTIONS

F V Traut, *chairman*
R R Frey, *secretary*

*One Year*—C R Gill.
*Vacancy to be filled.
*Two Years*—A I Hultberg, E R Kaswell.
*Three Years*—G S Buck, Jr, D E Marnon.
*Four Years*—*B K Easton, *Elliott Morrill.

### (S) TECHNICAL PROGRAMS

*J E Lynn, *chairman*

Committee to be appointed.

### (S) TECHNICAL SUPPLIES

G P Paine, *chairman*

*R E Derby, C W Dorn, G O Linberg, H W Stiegler.

### ARCHIVES

S M Edelstein, *chairman*

W H Cady, *R W Jacoby, N A Johnson, P J Wood, M J Lydon, *G P Paine.

### BIBLIOGRAPHY

W H Cady, *chairman*

V I McLendon, G F Walz, M S Furry, R K Worner, R D Greene, J W Place, Jr, A S Wrigley.

### COLOUR INDEX EDITING

W H Cady, *chairman*
W A Holst, *secretary*

W D Appel, J P Matteis, J R Bonnar, R W Jacoby, C A Sylvester.

### COLOUR INDEX MARKETING

A E Sampson, *chairman*
*G P Paine, *secretary*

G D Jackson, Jr, W H Cady, C W Dorn, R W Jacoby, *R E Derby, J A Doyle, P Theel.

### HOWES CONTRACT

E R Kaswell, *chairman*

*R E Derby, H F Herrmann, *R W Jacoby, G P Paine, F V Traut.

### INTER-SOCIETY RELATIONS

C Z Draves, *chairman*
*G P Paine, *secretary*

W D Appel, J R Bonnar, C W Dorn, *R W Jacoby, H W Stiegler, C A Sylvester.

### INTERSECTIONAL CONTEST

J A Woodruff, *chairman*

J R Gould, K A Howry, T R Smith.
Additional members to be appointed.

### PERKIN CENTENNIAL

R W Jacoby, *chairman*
E A Leonard, *vice chairman*
R R Frey, *secretary*
H F Herrmann, *treasurer*

W D Appel, J H Barnard, J R Bonnar, A G Bruinier, Jr, M A Dahlen, H E Hager, R J Hamilton, S L Hayes, P J Kennedy, G O Linberg, D E Marnon, G Meynell, W G Parks, A E Sampson, W M Scott, C A Whitehead, H L Young.

### PRESIDENT'S ADVISORY COMMITTEE

J R Bonnar, *chairman*
G P Paine, *secretary*

*R E Derby, *C W Dorn, *E J Finan, *W G Helmus, *R W Jacoby, E R Kaswell, *E Morrill, A E Sampson, *W M Scott, *H G Smith, T R Smith, J A Woodruff.

### QM—AIR FORCE DYE SURVEY

W A Holst, *chairman*

W D Baird, O C Bartenbach, W F Brommelsiek, C Byron (cooperating nonmember), J N Dalton, R E Derby, L Fusser, A W Grover, C W Lever, R A Link, Jr, L S Little, E A Lutz, A C Merrill, Jr, H E Millson, J H O'Donnell, R D Robinson, C H A Schmitt, H C Spatz, M G Stern, H W Stiegler, W von Bergen, W Wygand, Jr.

### SECTIONAL ADVISORY RESEARCH COMMITTEE

E W K Schwarz, *chairman*

Committee to be appointed.

### SUBJECT AND SPEAKER'S BUREAU

M J Babey, *chairman*
R R Frey, *recording secretary*

J A Doyle, C A Whitehead.
The Program Chairman of each Section is an ex-officio member.

### TEXTILE EDUCATION

H A Rutherford, *chairman*

Committee to be appointed.

NOTE: The president shall be ex-officio a member of all committees. The executive secretary — assistant treasurer to be an ex-officio member of all committees of the Council.

# ELECTED TO MEMBERSHIP

The following were elected to the indicated classes of membership in the American Association of Textile Chemists and Colorists on January 18, 1957:

*CORPORATE*

The Tanatex Corp

*SENIOR*

E M Allen
I M Ames
E E Anderson
N L Anderson
C J Baeringer
E B Baker
J B Baskin
E L Batchelder
F Beesley
H F Beutler
F Bleyer
N Brunelle
D G Channon
H E Conner
A I Darbey
D F Dix
J P Duffy
J V Einstein
R P Germann
G Haag
A G Heinel, Jr
P S Hess
W R Howell, Jr
H Irie
D E Johnson
T B Kay
D E McGuffin
F W McKenna
G E Mona
S J O'Brien
L H Platnick
C B Ratcliffe
C M Ross
J A Simmons, Jr
A A Verillo
R L Ward
C R Welch
J R Wiebush
R C Wilkie
D M Willis

*JUNIOR*

M Kornhauser
F B Percarpio
A H Whitlock
E L Wright

*ASSOCIATE*

V K Boyajian
R P Boyd
K J Campbell
F S Claghorn
F J DiCarlo
M Grossi
V H Hampton
A F Howey
J G Johns
L Taylor
K Matsuki
R E Miller
A J Natterman
P R Pagliuco
M Rubin
G Thomas

*STUDENT*

R C Arsenault
E E Backe
J R Blanchette
R Borge
E C Boyle
D E Branchaud
N A Burns
M H Clark
K P Conroy
A C Woodside
E I Creamer, Jr
J F Giblin, Jr
G L Harrison
J J Klocko
J P Loftus
D G Martin

*TRANSFERRED FROM OTHER CLASSIFICATIONS TO SENIOR*

J P Acquaviva
C C Bost
J K Brown
E F Carradori
W F Lewald
W R Martin, Jr
J M Mellion
E A Schlirf
F H Steiger

## PICTORIAL HIGHLIGHTS

### 205th Meeting of the Council

### January 18, 1957

George O Linberg (right) accepts the president's gavel from Raymond W Jacoby, retiring president, during the 205th meeting of the Council on January 18, 1957, as George P Paine, executive secretary-assistant treasurer looks on.

AATCC OFFICIALS (l to r)—H Gillespie Smith, vice president (Southern Region); Elliott Morrill, vice president (Western Region); Ernest R Kaswell, vice president (New England Region); George P Paine, executive secretary-assistant treasurer; George O Linberg, president; Weldon G Helmus, vice president (Central Atlantic Region); Roland E Derby, treasurer; Charles W Dorn, chairman, Executive Committee on Research; Richard R Frey, assistant secretary

## COUNCILORS ASSEMBLED AT 205TH MEETING

(Reading left to right)

*1st row*: Roland E Derby, treasurer; Albert E Sampson, retiring treasurer; Charles W Dorn, chairman, Executive Committee on Research; H Gillespie Smith, vice president (Southern Region); George P Paine, executive secretary-assistant treasurer; George O Linberg, president; Ernest R Kaswell, vice president (New England Region); Elliott Morrill, vice president (Western Region); Weldon G Helmus, vice president (Central Atlantic Region); Richard R Frey, assistant secretary

*2nd row*: Raymond J Carey, Western New England; Bernard K Easton, Niagara Frontier; Albert E Herrmann, Jr, representing Irwin J Smith for the Hudson-Mohawk Section; Arthur J Kellner, New York; Harry Moore, New York; Matthew J Babey, chairman, Subject and Speakers Bureau; John H Hennessey, New York; Frank J Rizzo, Northern New England; Richard A Shimp, Delaware Valley; John V Killheffer, Piedmont; J Robert Bonnar, past president; William D Appel, past president; Robert B Hallowell, Southeastern

*3rd row*: J Edward Lynn, Western New England; T Howard McCamy, Southeastern; Edward H Gamble, Rhode Island; Max Winkler, New York; Robert L Stutz, New York; Francis H Casey, Rhode Island; Carleton T Anderson, Delaware Valley; Philip S Durfee, Northern New England; Lawrence L Heffner, Washington

*4th row*: Jack Anderson, South Central; Raphael E Rupp, representing Henry A Rutherford for the Piedmont Section; Raymond W Jacoby, past president; Clarence Hooper, Piedmont; R Hobart Souther, Piedmont; William A Holst, chairman, Constitution and Bylaws Committee; Albert E Johnson, chairman, Corporate Membership Committee; Raymond B Taylorson, Rhode Island; J William Timperley, Rhode Island

*5th row*: A Henry Gaede, Piedmont; Eric W Camp, Mid-West; Paul B Stam, Piedmont; Carl Z Draves, past president; Arthur W Etchells, Delaware Valley; Walter M Scott, chairman, Publications Committee; P J Wood, past president

*6th row*: William H Bertolet 3rd, Delaware Valley; Clarence A Seibert, Delaware Valley; P J Fynn, New York; William F Brommelsiek, New York; Sidney M Edelstein, chairman, Archives Committee; Hubert A DesMarais, Pacific Southwest; John J Healy, Northern New England

## 1957 AATCC CONVENTION COMMITTEE

THE 1957 Convention Committee of the American Association of Textile Chemists and Colorists pauses for an official photo (including three Association officials as guests) at a recent organization dinner meeting in the Hotel Providence-Biltmore, Providence, RI.

*Seated clockwise at table:* George P Paine, executive secretary-assistant treasurer, AATCC; June R Ericson, University of New Hampshire, in charge of convention entertainment; Harrison M Gorton, Jr, American Aniline Products, Inc—hotel; Ernest R Kaswell, Fabric Research Laboratories, Inc—convention chairman; J Edward Lynn, consultant—technical program; Raymond J Carey, General Aniline & Film Corp—publicity; Edward S Chapin, consulting chemist—ladies; Henry X de Redon, Ciba Co, Inc,—dining.

*Standing (l to r):* Remus F Caroselli, Owens-Corning Fiberglas Corp—assistant convention chairman; Richard R Frey, assistant secretary, AATCC; Ernest J Chornyei, Bradford Dyeing Association—exhibits; Raymond B Taylorson, Verona Dyestuffs—reception; Thorwald Larson, Carbic-Moss Corp—printing; George O Linberg, Synthron, Inc—president; Azel W Mack, Dexter Chemical Corp—finance; and Thomas J Gillick, Jr, American Felt Co—assistant convention chairman.

# MEMBERSHIP APPLICATIONS

### SENIOR

Robert L Boynes—Textile colorist, Geigy Chemical Corp, Newton Upper Falls, Mass. Sponsors: W E Durgin, H J Mack.

Gerald H Brown—Dyer, Morgan Dyeing & Bleaching Co, Cleveland, O. Sponsors: A F Gorski, E G Iverson.

Richard H Bryden—Chemist, Arkwright Finishing Co, Fiskville, RI. Sponsors: A W Grover. M H Costello.

Raymond P Carney—Dye Salesman, E I du Pont de Nemours & Co, Inc, Rumford, RI. Sponsors: E H Gamble, J V Killheffer.

Donald L Cragen—Colorist, Cranston Print Works Co, Webster, Mass. Sponsors: G B Stackpole, J L Gerhard, Jr.

Lois A Dettmer—Textile chemist, J C Penney Co, New York, NY. Sponsors: P J Fynn, E Artim.

Anderson T Glenn—Representative, Scholler Bros, Inc, Philadelphia, Pa. Sponsors: W R Sargent, L N Hurley.

Joseph D Guerrieri—Assistant dyer, Lee Dyeing Co, Johnstown, NY. Sponsors: N Pratt, M Fishman.

Melvin D Hurwitz—Head of Textile Product Development Laboratory, Rohm & Haas Co, Philadelphia, Pa. Sponsors: W C Lindsly, A C Nuessle.

Nicholas S Janetos—Textile chemist, Owens-Corning Fiberglas Corp, Ashton, RI. Sponsors: F J Lachut, R K Gagnon.

Takeo Kanaoka—Chief of Technical Div, Japan Wool Textile Co, Ltd, Kobe, Japan. Sponsors: L Fusser, G E Neisser.

Austin P Morrill—2nd shift dyer, Princeton Knitting Mills, Watertown, Conn. Sponsors: P W Reeves, A W Goodwin.

Fred R Prater—Overseer, package dyeing, Standard Coosa Thatcher Co, Chattanooga, Tenn. Sponsors: J C Whitt. E V Helms

Marks P Underwood—Research chemist, Dan River Mills, Inc, Danville, Va. Sponsors: H M Chase, H Y Jennings.

Charles H Zimmerman—Technical sales, Polymer Southern, Inc, Greenville, SC. Sponsors: R E Rettew, J C King.

### ASSOCIATE

Robert B Acton—Special repres, E I du Pont de Nemours & Co, Inc, Manila, Philippines.

Clare D Bedell—Resident mgr, Pawtuxet Valley Dyeing Co, Inc, Phenix, RI.

Arthur B Crowell, Jr—Technical director, Union Paste Co, Hyde Park, Mass.

Shirley P Tilton—Chemist, Anderson, Clayton & Co, Fiber & Spinning Lab, Houston, Texas.

### CORPORATE

Berncolors, Inc

### APPLICATION FOR TRANSFER TO SENIOR MEMBERSHIP

Robert A Ford

### STUDENT

John E Howard—North Carolina State College. Sponsor: H A Rutherford.

# Activities of the Local Sections

## Western New England

A meeting of the Western New England Section was held on Friday, January 25, 1957 at Cavey's Restaurant, Manchester, Conn.

The guest speaker of the evening was S G Turnbull, Jr, assistant director of the Technical Laboratory, Dyes and Chemicals Division, E I Du Pont de Nemours & Co, Inc. Dr Turnbull spoke on "Dyeing the Newer Synthetic Fibers—A Dyer's Potpurri." The presentation featured a large exhibit of many of the materials discussed.

In spite of a hazardous snow storm, 45 members and guests were present.

**Shown at the Winter Meeting of the Piedmont Section, held January 26 at the Poinsett Hotel, Greenville, SC are:**

***Seated:*** **George O Linberg, Synthron, Inc, president, AATCC (left) and C O Stevenson, Ciba Co, Inc, Section chairman**

***Standing (l to r):*** **J C King, Metro-Atlantic, Inc, Section treasurer; M M Webber, Pabst Brewing Co, one of the guest speakers; Linton C Reynolds, Riegel Textile Corp, Section secretary**

**WESTERN NEW ENGLAND SECTION**
**MEETING OF JANUARY 25, 1957**
**CAVEY'S RESTAURANT, MANCHESTER, CONN.**

(Photos courtesy of A N Henschel)

SOUTHEASTERN SECTION SCHOLARSHIP AWARD—Paula Stevenson (center) a junior at the Georgia Institute of Technology, receives the Southeastern Section's annual scholarship award in textile chemistry at the Section's December 8th meeting. Award is made by H Gillespie Smith, American Cyanamid Co, vice president, AATCC (Southern Region), while James W Swiney, Fulton Bag & Cotton Mills, Section chairman, looks on.

Miss Stevenson is the first female student to be enrolled in Georgia Tech's textile chemistry course.

## Rhode Island

APPROXIMATELY 275 members and guests attended the Mid-winter meeting of the Rhode Island Section, held January 31st at Johnson's Hummocks Grille, Providence, RI.

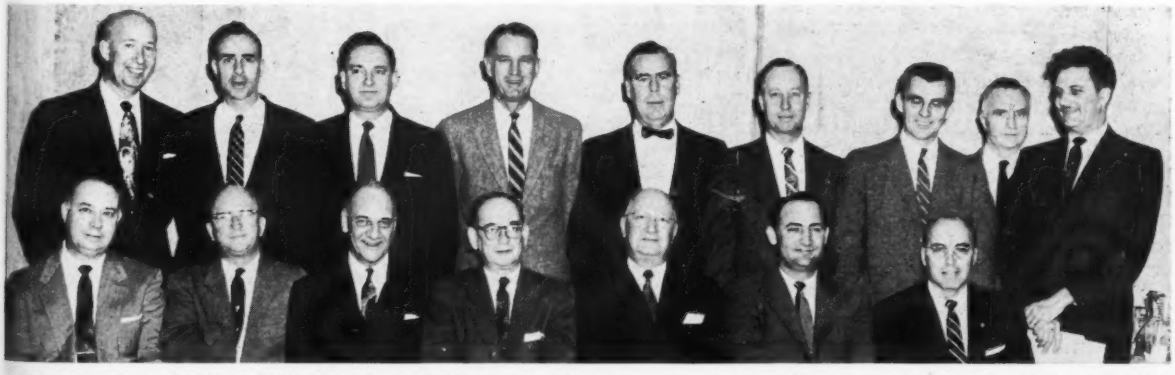
Chairman Remus F Caroselli, Owens-Corning Fiberglas Corp, introduced national president George O Linberg, Synthron, Inc, who lauded Raymond W Jacoby on his successful term of office and his excellent planning and carrying out of the Perkin Centennial celebration.

Speakers of the evening were Raymond Thornton, technical service manager, Arnold Hoffman & Co, Inc, who discussed "Procion Dyestuffs," and Theodore F Cooke, assistant to the manager, Textile Resin Dept, American Cyanamid Co, who spoke on "Comparison of Wrinkle-resistant Finishes for Cotton."

Mr Thornton summed up the novel and unique effects that can be readily obtained using high-speed techniques. During the presentation of the paper, he conducted a few experiments depicting typical reactions and processes. The novel fiber-reactive Procion dyestuffs and the explanation as to how their reaction properties with the fiber have been substantiated was fully explained. He also outlined the dyeing properties and the technical results which can be expected from these dyestuffs in dyeing and printing.

Dr Cooke presented the results of a study demonstrating a broad statistical analysis of the relationship of resin concentrations, catalysts, temperatures and time variations and their effects upon the physical properties of the treated fabrics. He outlined this extensive study covering the mechanism by which wrinkle-resistant properties are imparted to cotton by the use of urea, melamines, modified melamine and ethylene urea resins. He was able to clearly demonstrate the relationship of the various factors by means of a three-dimensional model. Some of the results show the worst catalyst to be ammonium sulfate, the best to be magnesium chloride.

## SOUTHEASTERN SECTION OFFICIALS FOR 1957



*Front row (l to r)*: Hazel L Whittle, Eagle & Phenix Fin Div, Reeves Bros, Inc, sectional committeeman; H Gillespie Smith, American Cyanamid Co, vice president, AATCC (Southern Region); Edward R Ravenel, Morton Salt Co, secretary; James W Swiney, Fulton Bag & Cotton Mills, chairman; William B Griffin, Dexter Chemical Corp, vice chairman; William B Fayssoux, Royce Chemical Co, treasurer; A Kempton Haynes, Rohm & Haas Co, custodian.

*Back row (l to r)*: R B Hallowell, Coats & Clark, Inc, councilor; T Howard McCamy, Seydel-Wooley & Co, councilor; Ralph Champion, Pepperell Mfg Co, sectional committeeman; J Elwood Barbre, Pepperell Mfg Co, sectional committeeman; Francis X Nerney, Becco Chemical Div, FMC, Intersectional Contest Committee member; George L Dozier, Southern Dyestuff Corp, sectional committeeman; Marc V Shivers, Thomaston Mills, Intersectional Contest Committee member; John C Cook, WRC Smith Publishing Co, publicity chairman; Paul V Seydel, Seydel-Woolley & Co, Intersectional Contest Committee.

# Activities of the Local Sections

## New York

THE January 23rd meeting of the New York Section, held at the Hotel Delmonico, New York, NY, took the form of a luncheon symposium, the theme of which was, "Changing Trends in Military Requirements." Attendance was approximately 230.

Chairman Donald E Marnon, American Aniline Products, Inc, serving as master of ceremonies, introduced the luncheon speaker, Brig Gen Victor J MacLaughlin, assistant quartermaster general, who discussed, "The New Look in Military Purchasing and Distribution."

Moderator for the panel discussions was Charles W Dorn, chairman of AATCC's Executive Committee on Research. Speakers were: S J Kennedy, US Army Quartermaster Corps, "How Atomic Warfare Has Changed Army Requirements for Textiles"; T J Serry, Department of the Navy, Bureau of Supplies and Accounts, "Textile Requirements for the Navy of the Future"; and J H Ross, Functional Textiles Section of the Textiles Branch, Material Laboratory, Directorate of Research, Wright Air Development Center, "Changing Trends in Requirements for Parachute Textile Materials."

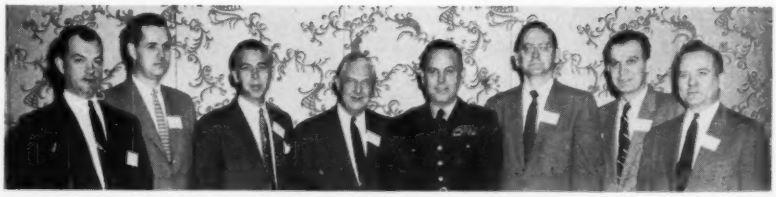
Special guests attending were: Capt Russell Brinley, First Army Headquarters, Governors Island; Col E H Millson, chief, New York Air Force Development Field Office; Col A J Roose, Marine Corps Supply Activity, Philadelphia; Lieut L J Challain, research and development officer, US Naval Supply Activities, Brooklyn; Lt Col J Rivard, Office Quartermaster General, Washington; V P Manganaro, assistant head, procurement branch, Marine Corps Supply Activity, Philadelphia; and J J Press, US Navy Clothing Supply Office, Brooklyn.

**MILITARY SERVICE PROCUREMENT REPRESENTATIVES and the moderator at the symposium on "Changing Trends in Military Requirements" held on Wednesday, January 23, 1957 at the Hotel Delmonico, New York, by the New York Section, AATCC, are shown.**

***Seated (l to r)*: Capt Russell Brinley, 1st Army Headquarters, Governors' Island, NY; Col E H Millson, chief, New York Air Force Development Field Office, Air Research and Development Command, USAF; Brig Gen Victor J MacLaughlin, assistant quartermaster general, Office of the Quartermaster General, Washington, DC; Col A J Roose, U S Marine Corps Supply Activity, Philadelphia, Pa; Lt L J Challain, research and development officers, Clothing Supply Office, US Naval Supply Activities, Brooklyn, NY.**

***Standing (l to r)*: Lt Col J Rivard, Office of the Quartermaster General, Washington, DC; Charles W Dorn, chairman of AATCC's Executive Committee on Research, moderator of the discussion; J H Ross, Functional Textiles Section, Textiles Branch, Material Laboratory, Directorate of Research, Wright Air Development Center, Dayton, O; Stephen J Kennedy, U S Army Quartermaster Corps, Research & Development Center, Natick, Mass; V P Manganaro, assistant chief, procurement branch, Marine Corps Supply Activity, Philadelphia, Pa; Thomas J Serry, Bureau of Supplies & Accounts, Department of the Navy, Washington, DC; Jack J Press, U S Navy Clothing Supply Office, Brooklyn, NY**

**SYMPOSIUM PRINCIPALS (l to r): Mr Ross, Mr Serry, Gen MacLaughlin, Dr Kennedy, Mr Dorn**



**SYMPOSIUM COMMITTEEMEN, LUNCHEON SPEAKER AND MODERATOR (l to r): Richard E Miller, Eastman Chemical Products, Inc; James A Doyle, Howes Publishing Co, Inc; Joseph J McGuinness, Dexter Chemical Corp; Mr Dorn; Gen MacLaughlin; Donald E Marnon, American Aniline Products, Inc; Matthew J Babey, American Cyamamid Co; Richard P Monsaert, Jr, Puritan Piece Dye Works**

**SEATED AT THE DAIS (l to r)—Weldon G Helmus, Fair Lawn Finishing Co, vice president, AATCC; Col Roose; Lt Challain; Col Millson; Mr Babey; Mr Dorn; Mr Marnon; Gen McLaughlin; Dr Kennedy; Mr Serry; Mr Ross; Mr Miller; Mr Monsaert**

The National Headquarters Office
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THE SECOND EDITION
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# THE COLOUR INDEX
IN FOUR VOLUMES
*published by*
The Society of Dyers and Colourists
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and Colorists
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***American Association of Textile Chemists and Colorists***
***Box 28, Lowell, Massachusetts***

## EXAMPLE OF ENTRY IN PART I

**C.I. 69025** Anthraquinone **C.I. Vat Orange 1**

### APPLICATION

METHOD

A/Q1 ☐
A/Q2 ■
A/Q3 ◘
Indigoid ☐

LEUCO COMPOUND
Alkaline, orange brown
Acid, brownish yellow

Vat in short liquor

### DYEING

PROPERTIES (COTTON) Affinity and levelling, good. For data on strike, levelling and migration see *JSDC*, **66** (1950), 505

Suitable for pigment pad-jig, pad-steam, continuous piece and vat-acid processes

**Cotton** Affinity and levelling good. Dead cotton covered fairly well

**Viscose** Good affinity at low temperature; at high temperature the hue is redder and duller

**Cotton/Viscose** Good solidity when dyed cold. At 50°C viscose dyed heavier than cotton

**Silk** Suitable

### PRINTING

**Cellulose** Applied by normal processes giving redder and duller hues than when dyed. Dischargeable in pale and medium shades in the presence of an assistant

### FASTNESS PROPERTIES etc

| | A | B | C |
|---|---|---|---|
| CROSS DYEING (Chrome) ... ... | .. | 5 | 5 |
| HOT PRESSING ... | 5 | 5 | 5 |
| HYPOCHLORITE ... | 5 | 5 | 5 |
| LIGHT ½–½ Normal | 5–6 | 6 | 6 |
| Normal | 6–7 | 6–7 | 6 |
| 2× Normal | .. | 7 | 6–7 |

| | A | B | C |
|---|---|---|---|
| MERCERISING ... | 5 | 5 | 5 |
| PEROXIDE BLEACHING | 5 | 5 | 5 |
| SODA BOIL (open kier) | 4–5 | 5 | 5 |
| SODA BOIL followed by HYPOCHLORITE ... (Combined test) | 4–5 | 4–5 | .. |

Tendering on exposure to light not accelerated

FASTNESS ON SILK (B) Degumming 5, Hot pressing 5, Light 6–7, Peroxide bleaching 4–5

### TEXTILE USAGE

DYEING

**Cellulose** On account of good level dyeing and all-round fastness as a shading colour where good light fastness is required. Suitable for curtains, hangings and for goods to be bleached, e.g. shirtings and towels

**Silk** For good fastness to degumming, peroxide bleaching and washing

**Unions** For cotton/viscose fabrics

PRINTING

**Cellulose** For direct print styles or as pigment with binder on cotton and viscose

HUE **Yellowish Orange**

ARTIFICIAL LIGHT: redder

| | |
|---|---|
| **Benzadone Gold Orange 3G** ... ... | **YDC** |
| **Caledon Gold Orange 3G** ... ... | **ICI** |
| **Carbanthrene Golden Orange 3G** ... | **NAC** |
| **Cibanone Golden Orange 3G** ... ... | **Ciba** |
| **Cibanone Golden Orange 3GⓅ** ... | **Ciba** |
| **Fenanthren Golden Orange 3G** ... | **G** |
| **Indanthren Golden Orange 3G** ... | **FBy** |
| **Indanthrene Golden Orange 3GA** ... | **G** |
| **Indanthrene Golden Orange 3GF** ... | **G** |
| **Indanthrene Golden Orange 3GWP** ... | **G** |
| **Ponsol Golden Orange 3G** ... ... | **DuP** |
| **Ponsol Golden Orange 3GD** ... ... | **DuP** |
| **Sandothrene Golden Orange N3G** ... | **S** |
| **Solanthrene Orange 3J** .. ... | **Fran** |
| **Tinon Chlorine Golden Orange 3G** ... | **Gy** |

**Reactions on Cellulose**

$H_2SO_4$ conc.— greenish blue

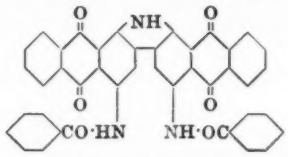
An example from the Vat dyes section of Part I is reproduced above and a specimen page (carbazole vat dyes) from the Anthraquinone section of Part II is shown opposite.

These two examples illustrate the information which appears in Parts I and II and demonstrates the dual reference system which connects the two Parts, e.g.

**C.I. Vat Orange 1** in Part I and **C.I. 69025** in Part II are complementary.

The format for the dyes in Part I varies with the amount of information available. Some dyes occupy a whole page, others only part of a page. For example, the space occupied by these notes may be used to accommodate information on **C.I. Vat Orange 2.**

**69005** **C.I. Vat Green 9** (*Brownish grey → Dull olive*)



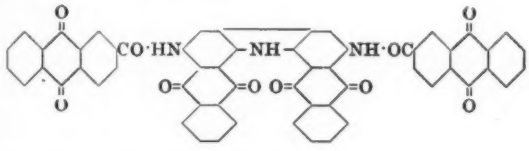
(*a*) Condense 1-benzamido-4-chloroanthraquinone with 1-amino-4-benzamidoanthraquinone in presence of copper and cyclise with chlorosulfonic acid
(*b*) Cyclise 4,4′-dibenzamido-1,1′-dianthrimide in sulfuric acid and oxidise the product

$Na_2S_2O_4$, alkaline — reddish brown; acid — yellowish brown

*Discoverer* — W. Mieg 1910
Bayer Co., *BP* 2702/09, 11932/09, 25986/09, 29352/10, 15753/12; *USP* 986521, 996109; *FP* 400653, 409407, 432449; *Sw.P* 55556; *GP* 220581, 225232, (*Fr.* **9**, 764, 1197), 228992, 239544, (*Fr.* **10**, 644, 638), 464292 (*Fr.* **16**, 1354)
Brit. Dye. Corp., *BP* 289191
*BIOS* 1493, 29; *FIAT* 1313, **2**, 135
*FIAT* 764 — Indanthrenoliv R
Vlies, *JSDC*, **30** (1914), 29
*Fierz-David*, 584 and Suppl. 82
*Houben*, 466, 662
*Mayer*, 181
*Fierz-David & Blangey*, Table 19
Fraser-Thomson, *JSDC*, **52** (1936), 242
*Thorpe*, **1**, 422

Soluble in *o*-chlorophenol
Slightly soluble in chloroform, pyridine
Insoluble in acetone, alcohol, toluene, xylene
$H_2SO_4$ conc. — red; on dilution — flocculent olive green ppt.

**69010** **C.I. Vat Green 22** (*Olive*)

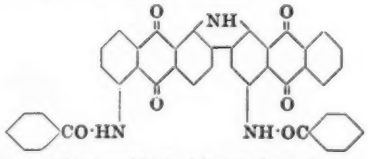


Condense 4,4′-diamino-1,1′-dianthrimide with 2 mol. 2-anthraquinonecarbonyl chloride and cyclise

*Discoverer* — F. Baumann 1929
I.G., *BP* 349714; *USP* 1819014; *FP* 696423; *GP* 513608 (*Fr.* **17**, 1398)
*BIOS* 1493, 28
*FIAT* 764 — Indanthrenoliv 3G

$H_2SO_4$ conc. — yellowish brown
$Na_2S_2O_4$, alkaline — reddish brown; acid — brownish yellow

**69015** **C.I. Vat Brown 5** (*Brown*)



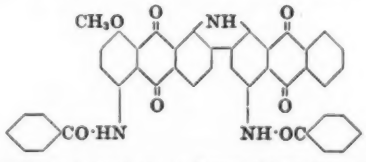
Condense 1-benzamido-5-chloroanthraquinone with 1-amino-4-benzamidoanthraquinone in presence of copper and cyclise with sulfuric acid

$Na_2S_2O_4$, alkaline — reddish brown; acid — yellowish brown

*Discoverer* — W. Mieg 1910
Bayer Co., *BP* 2702/09, 11932/09, 25986/09, 29138/09, 29352/10, 15753/12; *FP* 400653, 432449; *GP* 220581, 225232, (*Fr.* **9**, 764, 1197), 228992, 239544, (*Fr.* **10**, 644, 638), 491428 (*Fr.* **16**, 1349)
Brit. Dye. Corp., *BP* 289191
*BIOS* 1493, 10, 12; *FIAT* 1313, **2**, 106
*FIAT* 764 — Indanthrenbraun R, FFR
*Fierz-David*, 576 and Suppl. 82
*Mayer*, 181
Fraser-Thomson, *JSDC*, **52** (1936), 243
*Thorpe*, **1**, 422

Slightly soluble in xylene
$H_2SO_4$ conc. — dull wine red; on dilution — reddish brown flocculent ppt.

**69020** **C.I. Vat Brown 36** (*Reddish brown*)

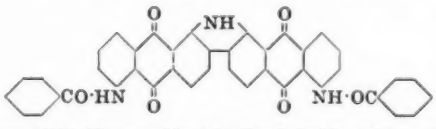


(*a*) Condense 1-amino-4-benzamidoanthraquinone with 1-benzamido-5-chloro-4-methoxyanthraquinone and cyclise
(*b*) Condense 1-amino-4-benzamidoanthraquinone with 1-benzamido-5-chloro-4-hydroxyanthraquinone, methylate the hydroxy group and cyclise with sulfuric acid

*Discoverer* — F. Baumann 1926
I.G., *BP* 298696; *USP* 1885172; *GP* 481362 (*Fr.* **16**, 1326)
*BIOS* 1493, 44
*FIAT* 764 — Indanthrenrotbraun 5RF
Fox, *JSDC*, **65** (1949), 513

$H_2SO_4$ conc. — violet; on dilution — red
$Na_2S_2O_4$, alkaline — brown; acid — brown (yellower)

**69025** **C.I. Vat Orange 1** (*Yellowish orange*)



(*a*) React 5,5′-dibenzamido-1,1′-dianthrimide with sulfuric acid and oxidise
(*b*) React 1-benzamido-5-chloro-anthraquinone with 1-amino-5-benzamidoanthraquinone in the presence of nitrobenzene and cupric chloride

*Discoverer* — P. Fischer 1910
Bayer Co., *Sw.P* 115114
Cassella Co., *GP* 239544 (*Fr.* **10**, 638), 249000 (*Fr.* **11**, 621)
*BIOS* 1493, 15, 77; *FIAT* 1313, **2**, 119
*FIAT* 764 — Indanthrengoldorange 3G
*Fierz-David* Suppl. 82
*Thorpe*, **1**, 423

Slightly soluble in nitrobenzene, tetralin, xylene
Insoluble in alcohol
$H_2SO_4$ conc. — greenish blue; on dilution — orange
$Na_2S_2O_4$, alkaline — yellowish brown; acid — yellow

# CONTENTS

The work has been completely re-designed and brought up-to-date with the co-operation of all the dye manufacturers in Great Britain, America, Western Europe, India and Japan. The 2nd Edition is in three main parts.

## PART I

**PART I**— consists of two volumes each of approximately 1,000 pages. It deals with all commercially homogeneous dyes and pigments in current use (approximately 4–5,000 dye entities and 25,000 commercial names) within groups relating to their main usage, e.g. Disperse, Acid, Azoic, Direct, Pigment, Solvent etc. The data included comprises the commercial name and manufacturer's initials, methods of application, fastness properties, established usages, reactions on the fibre and literature references relating to application. In the absence of a single accepted international system of fastness assessment it has been necessary, in this Edition, to make provision for the inclusion of data according to one or more of the following—

A— (American) The methods of The American Association of Textile Chemists and Colorists.
B— (British) The methods of The Society of Dyers and Colourists.
C— (Continental) The methods of the Deutsche Echtheitskommission.

An important feature of PART I is the sub-division of each usage group into hue groups— Yellow, Orange, Red, Violet, Blue, Green, Brown and Black. The hue classification has been made by reference to a Hue Indication Chart which has been designed specially for the purpose. A copy of the chart is included with each set of volumes.
Each dye or group of identical dyes carries a PART I serial name and number, e.g. **C.I. Vat Orange 1**, and also a five digit PART II number in those cases where the chemical constitution of the dye is known.

**VOLUME 1** Foreword — Preface — Contents of Volumes 1-4 — Introduction to Part I
Acid Dyes (including the premetallised dyes) — Mordant Dyes — Basic Dyes — Disperse Dyes — Natural Dyes and Pigments — Food (Food, Drug and Cosmetic) Dyes

**VOLUME 2** Direct Dyes — Sulphur Dyes — Vat Dyes — Ingrain Dyes — Azoic Dyes (sub-divided into Coupling Components, Diazo Components and Azoic Compositions) — Oxidation Bases — Pigments (inorganic and organic) — Solvent Dyes — Fluorescent Brightening Agents — Developers — Reducing Agents

## PART II

**PART II**— is one volume of approximately 700 pages. It contains data relating to chemical constitution, method of preparation, patent and literature references relating to manufacture or constitution, solubilities and reactions in substance for approximately 3,800 dyes and pigments. The 1st Edition recorded 1,316 constitutions, and this very big increase is partly due to the fact that many co-operating dye manufacturers have, for the first time, disclosed the constitution of certain of their dyes. In addition there is the information contained in the reports compiled by Allied Investigating Commissions on the German Dyestuff Industry.

The dyes are arranged in order based on their chemical constitution following broadly the lines of the 1st Edition. A number of refinements have been introduced and there are two new sections, viz— AZOIC (the coupling components and the diazo components for the production of Insoluble Azo dyes on the fibre) and PHTHALOCYANINE.

Each entry carries a five digit reference number. These numbers do not progress in unit steps as provision has been made to allow the insertion of new constitutions in later editions or supplements without having to change the numbers now allocated in the 2nd Edition. Each entry also carries the complementary PART I serial name and number thus providing easy cross reference to the data in PART I. It also contains alphabetical and empirical formula indexes to all the Intermediates relating to individual dye entities.

VOLUME 3 Introduction — Nitroso — Nitro — Azo — Azoic — Stilbene — Ketonimine — Triphenylmethane — Xanthene — Acridine — Quinoline — Methine — Thiazole — Indamine — Indophenol — Azine — Oxazine — Thiazine — Sulphur — Lactone — Aminoketone — Hydroxyketone — Anthraquinone — Indigoid/Thioindigoid — Phthalocyanine — Natural — Oxidation — Inorganic Pigments — Alphabetical index of Intermediates — Empirical formula index of Intermediates

## PART III

**PART III**— is one volume of approximately 400 pages containing the general index to PART I and PART II (see CONTENTS, [iv]). The Commercial Names Index includes the names (in italics) of dyes not in current use, many of which are related to data in PART I and/or PART II.

VOLUME 4 Hue Indication Chart (in pocket) — Dye Manufacturers' Initials (in alphabetical order) and Names — Dye Manufacturers' Names (in alphabetical order) and Initials — Abbreviations used in Parts I and II — Fastness Tests etc — Patents Index — Conversion Tables relating Colour Index 1st Edition to Colour Index 2nd Edition numbers and Schultz Farbstofftabellen (7th Edition) numbers to Colour Index 2nd Edition numbers and to AATCC Prototype numbers — Commercial Names Index — Additions and Corrections

### Delaware Valley

THE Educational Committee of the Delaware Valley Section, in conjunction with the Philadelphia Textile Institute, will sponsor a management course beginning on Monday, March 11th and meeting every Monday through April 15th.

The areas to be covered in this course include the following: Economics of Textiles, Practical Problems in Purchasing, Inventory Control, Cost Accounting for Effective Control, Personnel Management and Problems, Labor Relations at the Mill Level.

Guest lecturers will include experts from the textile industry and in textile education.

The sessions will be held at the Philadelphia Textile Institute, School House Lane and Henry Avenue, Philadelphia, Pa.

## Employment Register

*This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.*

57-3

*Education*: City College, New York —liberal arts; New Bedford Textile Inst (3 years) textile manufacturing; Philadelphia Textile Inst—woolen & worsteds; University of Pennsylvania —production engineering.

*Experience*: 17 years textiles, mill superintendent, manufacturing manager, sales, merchandising, styling, development, quality control director.

*Age*: 39; Married; References.

*Position Desired*: Textile manufacturing or sales, technical, administrative or executive.

*Locations Desired*: New York City or Carolinas preferred. Any domestic acceptable. Resume on request.

57-4

*Education:* University of Paris; State Textile Vocational School, Brno, Czechoslovakia — Degree textile chemist, dyeing & finishing.

*Experience:* 18 years experience: Dyeing-finishing cotton & synthetics; plant chemist.

*Age:* 38; Married; References.

*Position Desired*: Asst. plant mgr—supt, dyeing & finishing.

*Locations Desired*: Anywhere USA: South America.

## Future Papers

*The following material has been submitted to date to the publishers of American Dyestuff Reporter. Subject to the approval of the AATCC Publications Committee, it will appear in the Proceedings in future issues.*

*Authors, section officials, and committee chairmen are requested to inspect this list and notify the publishers if there are any omissions.*

*Papers presented at the Perkin Centennial under AATCC sponsorship:*

"The Development of Fast Colors for Textiles"— F M Fordemwalt, American Cyanamid Co

"The Development of the Art of Textile Printing"—Herman P Baumann, American Aniline Products, Inc

"The Development of Modern Textile Dyeing Techniques"—P L Meunier, E I du Pont de Nemours & Co, Inc

"The Application of Colorants to Glass Fibers"—R F Caroselli, Owens-Corning Fiberglas Corp

*Papers presented before local sections:*

"Far Infra-red for Textile Dyeing and Finishing"—W L Thomson, Edwin L Wiegand Co

"Lighting Factors to be Considered in Textile Color Matching"—Warren B Reese, Macbeth Daylighting Corp

"Progress in the Art of Bleaching" —B K Easton and N Weinberg, Becco Chemical Division

"Binders for Nonwoven Fabrics"— Neil H Sherwood, B F Goodrich Research Center

"Technology of Nonwoven Fabrics" —L G Lovin and L P Wenzell, Celanese Corp of America

"Developments of Science and Industry in the South"—Frank J Soday, The Chemstrand Corp

"Random Tumble Pilling Tester"— A G Scroggie, E I du Pont de Nemours & Co, Inc

"Recent Developments in Vat Dyeing"— J M Fletcher, E I du Pont de Nemours & Co, Inc

*Miscellaneous*:

"Leucoesters of Vat Dyestuffs"— Hans Luttringhaus, Progressive Color & Chemical Co

*Other Perkin Centennial Papers*

"A Century of Progress in Colorfastness Test Methods"— M L Staples, Ontario Research Foundation

"The Standard Depth of Shade in Relation to the Assessment of Colorfastness of Dyes on Textiles"—Paul

"Dyes and Dyeing Processes for Special Properties of Color"—J S Kirk, General Dyestuff Co

"Progress in Measuring Color Difference" — G W Ingle, Monsanto Chemical Co

"The Use of Color in National Defense"—S J Kennedy, Quartermaster Research and Development Command Rabe, Farbenfabriken Bayer AG

"Seeing Light and Color"—Ralph M Evans, Eastman Kodak Co

"The Chemistry of Organic Pigments"—A Siegal and W S Struve, E I du Pont de Nemours & Co, Inc

"Color in Relation to the Political and Economic History of the Western World"—S M Edelstein, Dexter Chemical Corp

"Color in Ancient Times"—Earle R Caley, Ohio State Univ

"Color Designation through the Ages"—Ernest R Kaswell, Fabric Research Laboratories, Inc

"Early Synthetic Dyes"—Hans Z Lecher, consultant

"Synthetic Dyes for Cotton"—D I Randall, General Aniline & Film Corp

"Dyes for Animal Fibers"—James Ogilvie, National Aniline Div

"Dyes for the Hydrophobic Fibers" —H E Schroeder and S N Boyd, E I du Pont de Nemours & Co, Inc

"Fluorescent White Dyes"—Robert S Long, American Cyanamid Co

"The Theory of Dyeing Cellulosic Fibers"—Emery I Valko, Onyx Oil & Chemical Co

"Theory of Dyeing Polyester and Polyacrylic Fibers"—W R Remington and H E Schroeder, E I du Pont de Nemours & Co, Inc

### ERRATUM

We regret a printing error which occurred on page P96 of the February 11th issue, in the article "The Interaction of Cellulose with Simple Salt Solutions and with Dyebaths," by Moncrieff-Yeates and White.

Equation (8′) should have appeared as follows:

$$\left(\frac{(SO_4)}{(SO_4)_o}\right)^{3/2} = \left(\frac{f_{(SO4)}\,\gamma_{(SO4)o}}{f_{(SO4)o}\,\gamma_{(SO4)}}\right)^{3/2} \left(\frac{1+\dfrac{[D]}{[SO_4]}}{1+\dfrac{f^2_{(D)}\,\gamma^3_{(SO4)}}{f^2_{(SO4)}\,\gamma^2_{(D)}}\,\dfrac{k\,[D]}{[SO_4]}}\right), \quad (8')$$

# WEAR TESTS WITH THE ACCELEROTOR

A R MACORMAC[1] and F M RICHARDSON
*Clothing and Housing Research Branch*
*Agricultural Research Service*
*U S Department of Agriculture*

## INTRODUCTION

THE laboratory abrasion tests reported here were made in the course of an investigation of methods of determining the comparative durability of wool fabrics and an attempt to develop means of correlating evidence of fabric degradation with length of time subjected to the Accelerotor.

Two chemical methods, alkali solubility and indigo carmine absorption, both of which have been used to measure damage to wool by chemical agents (*3, 5*), have shown poor correlation with wear periods. An important factor in the failure of textiles in wear is believed to be the breaking of the individual fibers into shorter pieces. These pieces, if very short, would tend to fall out. During this process the number of fibers per yarn cross section would tend to decrease and the number of fiber ends per fiber inch would tend to increase. This supposition is supported by an investigation of worn cotton shirts by Clegg, which indicated that one of the chief causes of failure was the breakdown of the individual fibers (*2*). Also, in a study by Rogers, Hays, and Hardy, microscopic examination of worn and unworn wool blankets showed a gradual change in the appearance of the fiber ends (*4*).

The object of the present study was to correlate the number of fibers per yarn cross section, the number of fiber ends per fiber per inch, and the character of the fiber ends with treatment in an Accelerotor for various periods of time.

## EQUIPMENT AND MATERIALS

The Accelerotor was decided on for the study in order to investigate its usefulness in laboratory wear tests. It is an instrument developed in the laboratories of the American Association of Textile Chemists and Colorists at Lowell, Massachusetts, to give rapid methods for determining fastness to washing and resistance to abrasion (*1*). In preliminary experiments in abrading fabrics in Lowell and in this laboratory, the Accelerotor reproduced results of actual wear more nearly than any other abrasion machine available, judged by visual and manual examination of the samples.

Essentially the Accelerotor consists of a water-tight chamber with collar and rotor. For washing tests, the chamber contains a detergent solution; it is used dry for abrasion tests. Several different collars and rotors may be used and the speed of the rotor varied, depending on the effects desired.

Fabrics used for the investigations were three navy blue worsted whipcords which were undergoing actual wear tests in the form of men's trousers:

No. 1 . . . . 100 percent 64's wool

No. 2 . . . . 75 percent 56-8's wool, 25 percent 3-denier staple rayon

No. 3 . . . . 75 percent 56-8's wool, 25 percent 3-denier nylon

## PROCEDURE

A 6-inch sample was unraveled for about one-eighth of an inch on all sides, and then the edges were coated with a free flowing adhesive (*1*). The samples were allowed to condition at 70°F and 65 percent relative humidity for at least 12 hours, and weighed. The Accelerotor was set up with the ribbed metal collar and the 4½-inch pitched rotor. The sample was run dry for 5 minutes at 3000 rpm, then allowed to condition for 2 hours and weighed. After the edges were recoated with adhesive, the sample was allowed to condition 12 hours, and run another 5 minutes. This was continued for the desired period. Recoating after each 5-minute run was necessary to overcome difficulty encountered with raveling of threads when only one application was used. Preliminary tests showed that a similar amount of adhesive was lost and re-applied each time.

Samples were weighed after each 5-minute interval of abrasion. The total time run was as follows:

Samples of fabric 1: 60, 75, and 90 minutes

Samples of fabric 2: 60, 75, and 90 minutes

Four samples of fabric 3: 60, 90, and 120 minutes

For the microscopic examination the worn samples were cut into two equal pieces along a warp thread. Three of the two-ply warp threads at least 4 inches long were separated and stained with dyes to make identification of the fibers simpler. Since counts by the microscope were made on the singles yarn, there were six determinations for each sample.

The staining procedure for the all-wool and the wool-rayon was as follows: In a small beaker bring to a gentle boil 10 ml of a solution containing 15 mg Direct Sky Blue FF (*Cl* 518), 10 mg Eosine G (*Cl* 768), 10 mg sodium chloride and 2 mg soap. Remove the source of heat and when the solution has stopped boiling but is still hot (about 200°F) put in the three threads. Allow to stand 15 minutes in the cooling solution. Rinse thoroughly in several portions of warm water. The same solution can be used several times. The wool is stained a bright pink and the rayon a sky blue.

For the wool-nylon the following staining procedure was used: In a small beaker heat to boiling 10 ml of a solution containing 200 mg of Identification Stain ODDA. Put in the three threads. Keep the solution hot (180°-200°F) for about three hours, allow the threads to remain in the cooling solution overnight. Rinse thoroughly in warm water. The same solution can be used several times. Wool is stained red and nylon blue.

Even when the original material was dyed a navy blue as in the present case these staining techniques gave colors strong enough to make identification of the different fibers definite. The three stained threads were separated and each kept in a small beaker of water, since experience indicated that the fibers were easier to handle in a wet condition. A wet thread (4 inches long) was placed in a twist counter and untwisted to give two singles threads. A sample of the singles yarn was again placed in the twist counter with the clamps set exactly 1 inch apart

[1]Now affiliated with the University of Alabama, University, Ala.

and the 1 inch untwisted, cut out and carefully mounted in water on a slide, teased apart, and covered with a cover glass. The whole area of the sample was surveyed and the number and type of fiber ends recorded. From the pieces of the singles yarn left in the twist counter cross sections were made in the Hardy microtome and the number of fibers counted. By this procedure the number of fibers per cross section and the number of fiber ends per fiber per inch were obtained.

## RESULTS AND DISCUSSION

Figures 1 and 2 plot the actual weights of samples after various periods of time in the Accelerotor. Figure 1 compares the all-wool fabric (1), wool-rayon fabric (2), and wool-nylon fabric (3), using the average of all results. The sharp decrease in weight in the first 5-minute period is probably due to loss of water, since all fabrics were conditioned before the tests and became heated during the test period. Subsequent weighings were made two hours after completing the test so that moisture regain is not a factor. The increase in weight shown by the all-wool fabric (1) is difficult to explain. It may be due to the greater tendency of wool to felt and thus mat together and take up more extraneous material and moisture. It should be noted that fabric 3 (wool-nylon) shows a slight tendency to increase in weight but fabric 2 (wool-rayon) does not. The most important feature of these curves after 15 minutes is the increasingly steep slope from the wool-nylon to the all-wool and finally the wool-rayon. From a practical point of view, the fabrics can be considered as worn out at the point the curve stops, ie, wool-nylon in 120 minutes, wool or wool-rayon in 90 minutes. These worn fabrics showed pinholes due to broken threads.

Figure 2 compares the four samples of fabric 3 run 60, 90, and 120 minutes. The same general trend of these curves indicates to what extent that reproducibility of results was approached.

The data obtained by microscopic examination of fabrics 1, 2, and 3 are presented in Tables I, II, and III, respectively. The percentage of worn ends and ends per fiber per inch were calculated and are shown in each table. In Tables II and III the percentage of wool, calculated on the basis of fiber count, is included. It indicates no change in the fabric composition during Accelerotor abrasion. The ratio of synthetic fiber

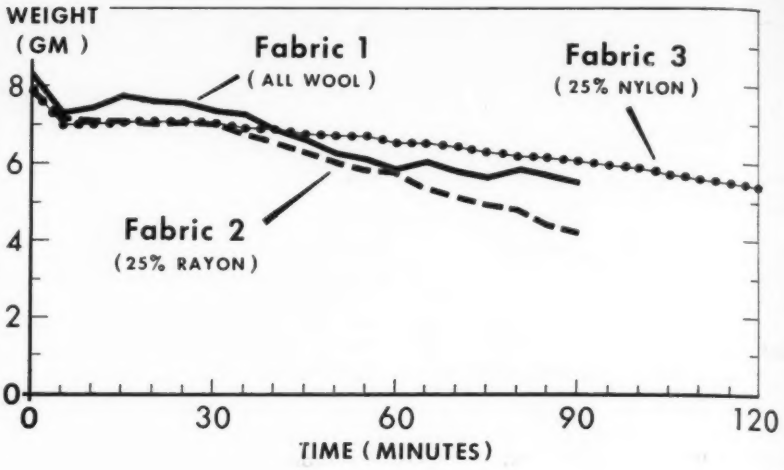



**Figure 1**

**Effect of wear tests in Accelerotor on weight of fabrics of wool and blends of wool with rayon and nylon (samples weighed every five minutes).**

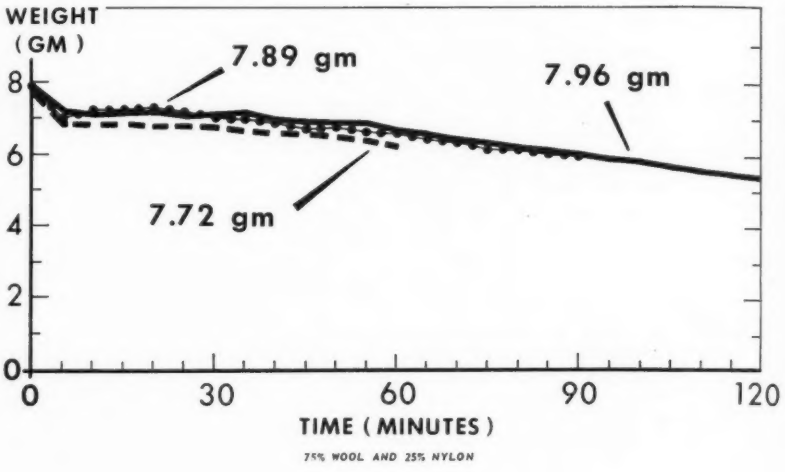



**Figure 2**

**Effect of various periods of Accelerotor wear upon weight of Fabric 3 (75 percent wool-25 percent nylon).**

**TABLE I**

**Accelerotor data on fiber ends: Fabric 1 (all-wool)**

| *Minutes in Accelerotor* | *Ends per inch* | | | *Fibers per cross section* | *Ends per fiber per inch* |
|---|---|---|---|---|---|
| | *Total* | *Worn* | *Percent worn* | | |
| Replicate 1: | | | | | |
| 0 | 690 | 6 | 0.8 | 403 | 1.71 |
| 60 | 1205 | 181 | 15.0 | 241 | 5.00 |
| 75 | 1367 | 225 | 16.4 | 281 | 4.86 |
| 90 | 1662 | 317 | 19.1 | 226 | 7.35 |
| Replicate 2: | | | | | |
| 0 | 706 | 5 | 0.7 | 318 | 2.22 |
| 60 | 907 | 136 | 15.0 | 208 | 4.36 |
| 75 | 776 | 171 | 22.0 | 223 | 3.48 |
| 90 | 900 | 233 | 25.9 | 241 | 3.73 |
| Replicate 3: | | | | | |
| 0 | 740 | 7 | 0.9 | 320 | 2.31 |
| 60 | 732 | 164 | 22.4 | 255 | 2.87 |
| 75 | 753 | 174 | 23.1 | 237 | 3.18 |
| 90 | 806 | 184 | 22.8 | 189 | 4.26 |
| Replicate 4: | | | | | |
| 0 | 778 | 6 | 0.8 | 387 | 2.01 |
| 60 | 798 | 181 | 22.7 | 263 | 3.03 |
| 75 | 796 | 140 | 17.6 | 197 | 4.04 |
| 90 | 797 | 219 | 27.5 | 188 | 4.24 |

**TABLE II**

**Accelerotor data on fiber ends: Fabric 2 warp (75 percent wool, 25 percent rayon)**

| Minutes in Accelerotor | Wool | | | | | Rayon | | | | | Percent wool fibers | Ratio of rayon ends to wool ends |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ends per inch | | | Fibers per cross section | Ends per fiber per inch | Ends per inch | | | Fibers per cross section | Ends per fiber per inch | | |
| | Total | Worn | Percent worn | | | Total | Worn | Percent worn | | | | |
| Replicate 1: | | | | | | | | | | | | |
| 0 | 559 | 8 | 1.4 | 182 | 3.07 | 365 | 4 | 1.1 | 103 | 3.54 | 64 | 1.15 |
| 60 | 935 | 219 | 23.4 | 137 | 6.82 | 615 | 19 | 3.1 | 66 | 9.32 | 68 | 1.37 |
| 75 | 713 | 200 | 28.1 | 106 | 6.73 | 503 | 18 | 3.6 | 59 | 8.52 | 64 | 1.27 |
| 90 | 359 | 112 | 30.9 | 71 | 5.06 | 197 | 11 | 5.6 | 44 | 4.48 | 62 | .89 |
| Replicate 2: | | | | | | | | | | | | |
| 0 | 444 | 5 | 1.1 | 197 | 2.25 | 224 | 6 | 1.9 | 104 | 2.16 | 65 | .96 |
| 60 | 482 | 143 | 29.5 | 108 | 4.46 | 349 | 12 | 3.4 | 63 | 5.54 | 63 | 1.24 |
| 75 | 363 | 115 | 31.7 | 80 | 4.54 | 221 | 7 | 3.2 | 32 | 6.91 | 71 | 1.52 |
| 90 | 269 | 92 | 39.2 | 58 | 4.64 | 172 | 17 | 9.9 | 33 | 5.21 | 64 | 1.12 |
| Replicate 3: | | | | | | | | | | | | |
| 0 | 427 | 9 | 2.1 | 174 | 2.45 | 235 | 4 | 1.7 | 92 | 2.55 | 65 | 1.04 |
| 60 | 577 | 154 | 26.7 | 126 | 4.58 | 362 | 10 | 2.8 | 68 | 5.32 | 65 | 1.16 |
| 75 | 410 | 144 | 35.1 | 68 | 6.03 | 315 | 25 | 7.9 | 42 | 7.50 | 62 | 1.24 |
| 90 | 394 | 134 | 34.0 | 74 | 5.32 | 237 | 6 | 2.5 | 54 | 4.39 | 58 | .82 |
| Replicate 4: | | | | | | | | | | | | |
| 0 | 359 | 2 | .6 | 166 | 2.16 | 299 | 3 | 10.0 | 104 | 2.88 | 61 | 1.33 |
| 60 | 377 | 97 | 25.7 | 83 | 4.54 | 268 | 6 | 2.2 | 45 | 5.96 | 65 | 1.31 |
| 75 | 323 | 97 | 30.3 | 58 | 5.57 | 214 | 11 | 5.1 | 22 | 9.73 | 73 | 1.75 |
| 90 | 270 | 95 | 35.2 | 79 | 3.65 | 188 | 6 | 3.2 | 43 | 4.37 | 63 | 1.20 |

**TABLE III**

**Accelerotor data on fiber ends: Fabric 3 warp (75 percent wool, 25 percent nylon)**

| Minutes in Accelerotor | Wool | | | | | Nylon | | | | | Percent wool fibers | Ratio of nylon ends to wool ends |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ends per inch | | | Fibers per cross section | Ends per fiber per inch | Ends per inch | | | Fibers per cross section | Ends per fiber per inch | | |
| | Total | Worn | Percent worn | | | Total | Worn | Percent worn | | | | |
| Replicate 1: | | | | | | | | | | | | |
| 0 | 285 | 5 | 1.8 | 139 | 2.05 | 164 | 27 | 16.5 | 76 | 2.16 | 65 | 1.05 |
| 60 | 345 | 96 | 27.8 | 100 | 3.45 | 212 | 21 | 9.9 | 58 | 3.66 | 63 | 1.06 |
| 90 | 474 | 180 | 38.0 | 145 | 3.27 | 211 | 6 | 2.8 | 72 | 2.93 | 67 | .90 |
| 120 | 231 | 98 | 42.4 | 95 | 2.43 | 155 | 0 | 0.0 | 48 | 3.23 | 66 | 1.33 |
| Replicate 2: | | | | | | | | | | | | |
| 0 | 321 | 8 | 2.5 | 174 | 1.84 | 176 | 3 | 1.7 | 93 | 1.96 | 65 | 1.06 |
| 60 | 250 | 62 | 24.8 | 101 | 2.48 | 123 | 1 | 0.8 | 60 | 2.05 | 63 | .83 |
| 90 | 265 | 72 | 27.2 | 99 | 2.68 | 178 | 3 | 1.7 | 53 | 3.36 | 65 | 1.25 |
| 120 | 378 | 121 | 32.0 | 112 | 3.32 | 230 | 2 | 0.9 | 64 | 3.59 | 64 | 1.08 |
| Replicate 3: | | | | | | | | | | | | |
| 0 | 418 | 29 | 6.9 | 168 | 2.49 | 198 | 0 | 0.0 | 98 | 2.02 | 63 | .81 |
| 60 | 338 | 92 | 27.2 | 125 | 2.70 | 234 | 8 | 3.4 | 67 | 3.44 | 65 | 1.27 |
| 90 | 396 | 173 | 43.7 | 100 | 3.96 | 181 | 6 | 3.3 | 59 | 3.07 | 63 | .77 |
| 120 | 290 | 114 | 39.3 | 81 | 3.58 | 160 | 1 | 0.6 | 50 | 3.20 | 62 | .89 |
| Replicate 4: | | | | | | | | | | | | |
| 0 | 266 | 4 | 1.5 | 149 | 1.79 | 110 | 0 | 0.0 | 73 | 1.51 | 67 | .84 |
| 60 | 416 | 112 | 26.9 | 104 | 4.00 | 208 | 15 | 7.2 | 52 | 2.50 | 67 | .62 |
| 90 | 490 | 173 | 35.3 | 124 | 3.95 | 221 | 3 | 1.4 | 62 | 3.56 | 67 | .90 |
| 120 | 492 | 195 | 39.6 | 133 | 3.70 | 272 | 3 | 1.1 | 64 | 4.25 | 68 | 1.15 |

**TABLE IV**

**Average number of ends per fiber per inch**

| Minutes in Accelerotor | Fabric 1 | Fabric 2 | | Fabric 3 | |
|---|---|---|---|---|---|
| | Wool | Wool | Rayon | Wool | Nylon |
| 0 | 2.06 | 2.50 | 2.78 | 2.04 | 1.91 |
| 60 | 3.82 | 5.10 | 6.54 | 3.16 | 2.92 |
| 75 | 3.89 | 5.72 | 8.17 | — | — |
| 90 | 3.90 | 4.67 | 4.61 | 3.46 | 3.23 |
| 120 | — | — | — | 3.26 | 3.57 |

ends to wool fiber ends given in the last column of these tables, varies considerably and shows no consistent tendency to increase or decrease with length of the abrasion period. This would indicate that both fibers in the blend tend to break at approximately the same rate. The percentage of worn wool ends shows a consistent relationship with the amount of Accelerotor abrasion, but no definite trend is shown by the percentage of worn synthetic fiber ends.

In Table IV the average number of ends per fiber per inch is presented for each fiber in the three fabrics. Here it is apparent that in the wool-nylon blend the breaking of both fibers proceeded at a slower rate than in the other two fabrics.

## SUMMARY

Three worsted whipcords have been tested for wearing qualities by means of the Accelerotor. After the initial period of 15 minutes, the fabrics showed a consistent loss in weight with increasing time in the Accelerotor. The wool-nylon blend was more resistent to this type of abrasion than the all-wool or the wool-rayon fabrics. Data from microscopic examination of fiber ends confirms this conclusion. The percentage of worn wool ends consistently increased with increased time in the Accelerotor, indicating a good method for measuring the abrasive damage received by wool fabrics in this machine.

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# Abstracts

## Sensitivity of Vat Dyes to Sunlight in Presence of Soap

Khera, M P and Kapoor, S P, *Indian Textile J* 66, 687-8, August, 1956.

A factor which so far seems to have been overlooked in assessing fastness to light of dyed fabrics, according to the authors, is the presence of small quantities of soap in the fabric; the soap may be present either as such, due to incomplete rinsing out after washing, or as insoluble Ca or Mg soap due to the use of hard water.

This factor of the sensitivity of dyed fabrics to soap in the presence of light is more important from the point of view of those countries where clothes are washed with soap (as distinct from synthetic detergents), the water for washing purposes is not specially softened, and the clothes are dried by exposure to sunlight.

Investigations carried out for improving the fastness of olive green shade (OG) for army uniforms (a mineral khaki dyeing topped with vat dyes) showed that the dyeings could withstand repeated washing and had a light fastness of almost 8. In actual practice, however, the made-up uniforms when subjected to usual Indian washing showed considerable fading after the first few washes. Experiments were therefore undertaken to find out the reasons for this apparent disagreement.

To study the effect of various detergents on the light fastness of dyed fabrics, an apparatus was set up for keeping the dyed fabric moist with the detergent solution being tested, while the fabric was being exposed to sunlight. The apparatus was kept facing the sun at an angle of 45° to the horizontal. The rate of flow of the detergent solution on the fabric was adjusted so that drops trickled on so as to keep it just moist.

In one test, OG fabrics, both mineral khaki topped with vats and straight vat-dyed, were moistened with soap and distilled water respectively and exposed to sunlight. The fabrics moistened with soap showed a marked change in shade after 50 hours. The ones with water only were unchanged.

In another test, the soap was compared with sodium carbonate solution and with a synthetic detergent. Again the fabrics with soap showed a marked change; the ones with sodium carbonate showed a perceptible change; the ones with the synthetic detergent were unaffected.

It would appear that the probable cause of fading of the fabrics moistened with soap was the breakdown of the unsaturated soap molecules, the authors reported.—WHC

## Properties and Handling of Agilon Yarn

Armitage, N C, *Can Textile J* 73, 59-63, October 19, 1956.

The author discusses the characteristics of Agilon stretch or bulked yarns, and states that the process developed by his company may be used to crimp a filament or bundle of filaments to any desired extent, ranging from a wave to tight coils, and thus can produce a mildly bulked yarn, a heavily bulked yarn, or a stretch yarn, regardless of total denier, which may vary from 6 to 6000.

In passing through the Agilon process, the author states, the yarn is subjected to rearrangement of its molecular structure, and this causes a shrinking of the faces of the filament so that the face on one side becomes permanently shorter than that on the other side by a proportion up to between 10 and 15%. This differential shrinking puts a crimp into the yarn in the form of a coil.

The yarn must then be subjected to heat in order to relax it to a condition where the crimp tendency inserted during the processing can assert itself.

Normally the crimp is not developed in the yarn until it goes into the fabric or article into which it is to be woven or knit.

The principal field in which Agilon yarn is being used today is women's hosiery. The yarn provides good knitability, and the stockings possess high tensile strength and long wear. Agilon is also used in men's halfhose, combined with cotton.

The author gives instructions for handling the greige fabrics through the scouring and dyeing operations. A cationic softener is recommended for finishing.

Agilon high-denier yarns have been processed into rugs and carpets of both woven and tufted manufacture. This development is still in the experimental stage.—WHC

## Progress in the Electron Microscopy of Textile Fibers

Guthrie, J C, *J Textile Inst* 47, P248-68, April, 1956.

The author refers to an article by D G Drummond *J Textile Inst* 36, P131, 1945) which describes in detail the basic principles of the electron microscope. He states that this type of microscopy has developed techniques of its own (eg, ultra-thin sections, electron staining, shadowing, replicas, etc). These are all described, as well as various modifications that have been made in existing instruments by different investigators.

Fibers present many difficulties with the optical microscope, owing to low resolving power and small depth of focus, and the high magnification required to examine the surface of a fiber allows only a limited part of the curved surface to be accurately focused at one time. It is claimed that reflection electron micrograms are superior in resolution and depth to those obtained by conventional optical methods, and have the advantage of presenting a focused image of a large part of the curved surface.

The technique of preparing textile fibers for examination in the electron microscope is explained by the author, also the cutting of the sections. Generally, all textile fibers are too massive for direct examination by transmission, and must be broken down by various means, which are described.

The author refers to various investigations that have been made with the electron microscope, including studies of fiber surface, the fibrillar structure of fibers, particle size, etc. He believes that the instrument is a promising tool for supplying further information on the fine structure of fibers. He comments that he has not seen any reports of investigations on dyed fibers, and thinks this might be a field in which useful information could be obtained.

The article is illustrated by a number of excellent electron micrograms of fibers, including nylon, acetate, cotton, Orlon, rayon and wood.

There are 155 references to the literature.—WHC

## Some Aspects of Modern Dyeing and Finishing of Man-made Fibers

Geering, R C, *Can Textile J* 73, 43-8, August 10, 1956.

The author reviews the dyeing properties of the three most important groups of man-made fibers.

*Polyamide Fibers.* Polyamide, be-

ing such a strong and durable fiber, calls for dyeings which are just as durable as the fiber itself. Recently the conventional acetate dyestuffs lost ground to a selected group of acid colors which yield much better fastness properties. The acid and metallized dyes, however, tend to emphasize warp streaks and barré, caused by a difference in dye absorption of adjacent yarns. Levelling agents have been suggested, either as pretreatments or in the dyebath. It is believed that these levelling agents work by two different principles: namely, by competition with the dyestuff for the dye sites of the fiber, and by swelling of the fiber surface. The so-called "levelling salts" belong to the first class, and phenol belongs to the second category.

The author discusses beam dyeing of polyamide fibers, and refers briefly to printing and finishing.

*Acrylic Fibers.* The staple fiber can be dyed with three different classes of colors, namely, acetate, acid and basic. The dyeing with acetate colors is generally limited to light and medium shades of moderate fastness properties. These disperse colors are applied at the boil with or without swelling agents.

Acid colors are applied by the cuprous-ion method, and are especially useful for dark shades with excellent fastness properties.

The most important class of colors for these fibers is that of basic or cationic dyes. Certain selected types of this class yield excellent fastness properties. They exhaust without the use of swelling agents or mordants, and are dyed from a slightly acid bath containing acetic acid and a nonionic agent.

*Polyester Fibers.* These fibers are dyed with a special selection of disperse dyes, with the addition of swelling agents or carriers, of which there is a wide variety. Developed colors are used for dark shades. Various problems associated with these fibers are described.

The author also reviews the dyeing of blends of acrylic fibers and wool, and of polyester fibers and wool.—WHC

## The Photochemical Oxidation of Wool in the Presence of Fluorescent Compounds

Graham, D R and Statham, K W, *J Soc Dyers Col* 72, 434-8, September, 1956.

In recent years there has been an increase in the use of fluorescent brightening agents in the production of white textile materials. For wool this "optical bleach" is usually combined with a chemical bleach, eg, hydrogen peroxide or sulfur stove. However, on exposure to sunlight, wool so treated, particularly when in a damp condition, becomes yellowish brown. This color is darker than that of normal unbleached wool, and comparison with unexposed parts (eg, folded parts) of the "optically bleached" material shows the contrast to be very great.

The production of a yellow discoloration on untreated silk and wool has been noted previously, but the time of exposure was often several days. In the case of wool treated with fluorescent brightening agents, however, considerable discoloration frequently occurs in bright sunlight in about 1-2 hours when the samples are wet.

The authors found that the discoloration was produced mainly on the surface of the fabric exposed to sunlight, and did not extend to the unexposed surface except after prolonged exposure.

The rate of discoloration appears to depend directly on the amount of fluorescent agent present on the wool, and is greater for bleached than for unbleached wool.

The presence of water was found to accelerate the rate of discoloration to a very great extent, as samples treated with all the commercial fluorescent agents tested showed, when exposed dry, no appreciable discoloration in the time required to produce severe discoloration on wet samples.

The discoloration which occurs is due to oxidation of the wool, and appears to be independent of the fluorescent agent used. There is considerable evidence to show that oxidation of the amino acid tryptophane is the main color-producing reaction.—WHC

## Application Methods for Improving Levelness of Dyes on Nylon

Brooks, J A, *Tech Bull (du Pont)* 12, 91-8, July, 1956.

A number of different processes have been developed for improving dye levelness on nylon fabrics, particularly filament types.

In dyeing nylon tricot with acid dyes, greatly improved levelness can be attained through 1) the addition of a fatty alcohol sulfate (eg, Duponol D) to the dyebath, 2) operation at 235° to 250°F, 3) proper selection of dyes.

For pastel to light shades, pretreatment of the fabric with about 5% Duponol D and acetic acid, followed by dyeing at 212°F with the proper selection of dyes, produces important improvement in levelness.

Many of the ordinary acid colors that can be applied levelly at 235°F do not offer adequate lightfastness for end uses intended for woven goods, particularly on dull nylon. Because of the higher lightfastness requirements it is often necessary to use selected Capracyl-type dyes. These dyes alone or in combination are best leveled at 250°F with a levelling salt in addition to the Duponol D, adding acetic acid to exhaust the bath.

Efforts to improve levelness of nylon on the Burlington Beam Dyer and the Barotor machine are described by the author. He states that with the Barotor, large yardages of heavy constructions can be processed. To accomplish the required advance of cloth on the rotor during the dyeing, a relaxed boil-off or heat-setting is required.

In using the Burlington Beam Dyer, the problem of moire in dark shades can be minimized to a large extent by wrapping the steel beam with a one-inch layer of a preshrunk dye-resisting fabric, such as a net or raschel knit fabric of Orlon type 81.

The author describes the Cheney method of applying acid dyes at 212°F in a closed jig in the presence of phenol buffered with sodium acetate. It is stated that luster streaks on semi-dull and dull nylon are minimized by using this method.—WHC

## A Copper Process for Prolonged Microbiological Protection of Cellulosic Fabrics by Chemical Modification

Abrams, E and Bottoms, R R, *Textile Research J* 26, 630-40, August, 1956.

Copper in a variety of forms has been used as a fungicide for many years. All of the copper fungicides apparently act as poisons. As such, it is necessary that they have some degree of solubility to affect cellulolytic microorganisms. This solubility, whatever its degree, ultimately results in the complete loss of the fungicide from the cellulose that it is protecting.

A new process for prolonged mildew resistance of cellulosic materials has now been developed. This consists of treating cellulose with a dilute solution of copper formate, followed by a heat treatment. This heat treatment is an important part of the process.

Apparently the reaction product of this copper compound and cellulose does not act as a poison for cellulolytic microorganisms. Rather, the copper appears to be involved in a cross-linking between adjacent molecules of cellulose.

The process is a simple one. It has been applied to cotton, rayon, and

*(Concluded on page 154)*

# • PATENT DIGEST •

## DYEING ACRYLONITRILE FIBERS WITH DIRECT DYES———Phosphonium Compounds Added C,4,07

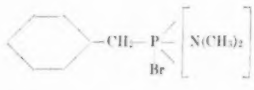
USPat 2,746,836 (Monsanto Chem Co——Rossin ——May 22, 1956)

PAUL WENGRAF

Acrylonitrile homo- or copolymers are well known for their property to resist dyeing with direct cotton dyestuffs.

It is claimed that these fibers can be dyed with direct dyestuffs in deep shades by using certain water-soluble quaternary phosphonium compounds as assistants, either by incorporating them into the spinning solution, by preparing the fibers with these compounds before dyeing, or by adding them directly to the dyebath. The last procedure is preferred: the phosphonium salt in amounts of 0.1-15% (preferably 4-10%) is added to the bath containing the usual ingredients besides the direct dye. The bath is heated to about 70° C and optionally to 100° C. After a major portion of the dye has been exhausted the bath is cooled, the fabric is rinsed and dried. In some instances the dye may be even completely exhausted. *Amino- and benzyl substituted phosphonium salts* are essential for this process.

*Example:* A copolymer yarn material containing 90% of acrylonitrile and 10% of vinyl chloride is immersed in a dyebath of 2% of Stilbene Yellow G (*CI* 620), 20% of sodium sulfate and 8% of tris (dimethylamino) phosphonium bromide brought to the




boil within 10 min and maintained boiling temperature for 60 min. then cooled down within 10 min. After being rinsed and dried the yarn had a satisfactory shade, while a specimen dyed the same way in absence of the phosphonium salt was barely tinted.

*Among the references cited by the Patent Office:*

*Am Dyestuff Reptr* 25, 561-5 (1936) (Hall) reports on some textile assistants, such as quaternary ammonium and phosphonium compounds and ternary sulfonium compounds, the phosphonium compounds being particularly described in Brit Pat 435,443 (I G Farbenind of Sept 16, 1935) as vat dye assistants.

*J Soc Dyers Col 61*, 121-5, (1945) (McGregor and Pugh): dyeing of nylon with a direct cotton dye in presence of a "cationic soap". Examples are cetylpyridinium bromide, hexadecyl triethyl ammonium bromide, cetyl phosphonium bromide and so on.

USPat 2,254,965 ("Patchemi"/1941) suggests dyeing in the presence of agents, giving off surface-active cations, among them ammonium, sulfonium and phosphonium compounds (eg, dodecyl phosphonium bromide).

USPat 2,343,095 (Du Pont/1944): preparing resin solutions in emulsion polymerization in the presence of a cation-active agent. Examples are: long chain alkylpyridinium bromide or phosphonium bromide.

USPat 2,543,316 (Un Carbide & Carbon Corp/1951): dyeing of thermoplastic fibers, especially vinyl-acrylonitrile copolymers with acid, direct, basic and phthalic anhydride type dyestuffs at elevated temperatures and under pressure [cf *Am Dyestuff Reptr* 40, 375 (1951)].

## Abstracts———

*(Concluded from Page 154)*

other cellulosic textiles, and to wood and paper. Preferably, the fabric is impregnated with an aqueous solution of copper formate at room temperature in a padder. The fabric is then dried and is autoclaved at a pressure of 15 psi, which corresponds to 120°C. Autoclaving for 20 to 30 minutes is sufficient to convert the brilliant green copper formate to a tan color. Cotton fabrics thus treated resist soil burial for 14 weeks without significant loss in strength.

It appears that this process deposits copper formate in the amorphous regions of cellulose which, perhaps by ion exchange, attaches copper to OH groups. During autoclaving, formic acid is liberated, and the attached copper compound bridges across adjacent cellulose molecules, perhaps bound by secondary valences or Vander-Waals forces.

The copper is said to be insoluble in most copper solvents, such as ammonia.

Mildew-resistant cotton garments are possible, since the treated fabric does not irritate the skin.—WHC

## "Care-free" Fabrics and Garments

Dorsey, B C M, *Textile Mfr* 82, 310-12, June, 1956.

"Care-free" fabrics are those which have their essential properties (eg, stiffness, gloss, etc) so permanently fixed that only a minimum of care and attention on the part of the user is required to preserve them throughout the life of the fabric.

All the new finishes that have become practicable in the production of "care-free" fabrics are based on methods for restricting the movement of the chain molecules of which all fibers are built up. Finishers have found that it is much better to modify the inside of a fiber (ie, by restricting fiber and thread movements by sticking them together with adhesive substances) than to modify the fabric as a whole.

Both creasing and shrinkage of a fabric can be traced to the effect of unrestricted movement of the molecules within the fibers. One method of avoiding this movement (in the case of the cellulosic fibers) is to fill the spaces between the molecules with a synthetic resin. Another method is to subject the material to a treatment (eg, with formaldehyde) which results in a cross-linking of the cellulose molecules.

Defects sometimes encountered in these applications include a yellowing of white goods, an adverse effect on the fastness of the dyes used, embrittlement of the fibers, an objectionable odor (usually fishy), and retention of chlorine.

Fishy odors are usually associated with the use of ammonium salts as catalysts. Alternative amine salts and magnesium chloride are now being used in preference.

Glyoxal has largely replaced formaldehyde for cross-linking. A new combination glyoxal and resin treatment, to produce both creasings and shrinkage resistance, is described. This is said to preserve the soft hand of the fabric and improve the reistance to wear.

The author also describes the "care-free" properties of fabrics made from the synthetics (eg, nylon and Terylene). Permanent pleats are produced by exposing the folded material to high-temperature steam, to set the fibers in positions which they tend to retain so long as the temperature of this setting treatment is not exceeded.

He anticipates that more and more use will be made of treatments directed to modifying the molecular structure of the fibers.—WHC

# News of the Trade

## Wallerstein-Baxter Merger

Signing of the contract for merging Wallerstein Company, Inc, New York, NY, with Baxter Laboratories, Inc, Morton Grove, Ill, was announced Feb 11th in Chicago and New York by William B Graham, Baxter Laboratories' president and Harold E Smith, president of Wallerstein company.

In the merger, all outstanding stock of Wallerstein Company is to be acquired by Baxter Laboratories from Lehman Brothers, New York investment bankers, and associates for an undisclosed amount of cash and $1,-800,000 of subordinated debentures convertible into Baxter common stock at $16 per share.

"Although the two companies serve different fields, we have much research interest in common" said Mr Graham in making the merger announcement. "Cooperation and exchange of information between the research groups should result in greater research productivity and new product development to the benefit of both companies and the areas each serves."

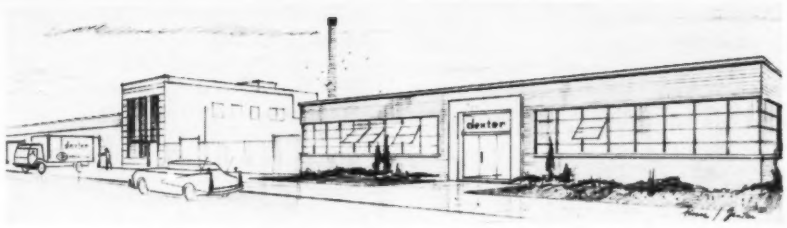
Baxter Laboratories primarily serves the hospital and medical specialty fields. Wallerstein Company, considered one of the nation's leading authorities on production and industrial use of enzymes, serves the fields of textiles, drycleaning, brewing, tanning, confectionary, baking and pharmaceuticals.

Wallerstein Company will operate independently. Its production, research, technical services and sales activities will continue to serve the specialized areas in which the company has made its reputation. Wallerstein Company was founded in New York in 1902 by Max and Leo Wallerstein, who established a consulting and analytical laboratory mainly for the brewing industry.

## OMCC Planning Increase in HTH Capacity

Plans for a 25 percent increase in capacity for the manufacture of HTH high-test calcium hypochlorite were announced recently by the Industrial Chemicals Division of Olin Mathieson Chemical Corporation, Baltimore, Md.

The new capacity will be obtained through modernization and addition of equipment at the company's existing HTH plant at Niagara Falls, NY. Completion of the work is scheduled for early fall.




Artist's Sketch of Dexter Chemical Corp's new office facilities

## Dexter Completes Modern Office Building

Dexter Chemical Corp has completed construction of a modern office building on land adjacent to its present manufacturing facilities. The brick and steel structure, according to Dexter officials, is the first step in a broad expansion program which will be completed by the first of September. Plans call for a new plant for manufacture of resins and recently-developed synthetic organic chemicals, also completely new research and development laboratories.

The executive and general offices were moved into the new building February first. The interior decor was done by the designing firm of Finn-Jenter.

The recently vacated offices in the plant are being remodeled to give larger facilities to the production and control laboratories and more adequate space for plant supervisors.

Dexter's 1957 winter sales meeting was held in the conference room of the new office building. The three-day session opened Feb 11.

## New Calgon Plant

The new Calgon processing and packaging plant of Hagan Chemicals and Controls, Inc, at Rockwood, Mich, opened officially on Thursday, February 7. Guests of the Hagan Board of Directors included municipal officials and business associates from nearby communities, division managers of the Hagan organization, and the press. In the evening, the directors held an open house for plant employees and their families.

The plant is located on a 45-acre tract adjacent to the Michigan Central Railroad, and within easy access to the Detroit-Toledo express highway. It is currently producing Calgon products for household and commercial use.

Calgon products are made from sodium hexametaphosphate, a material which was lifted from the laboratory chemical class to a commercial product through research and merchandising pioneered by Hagan. It has outstanding properties for preventing and removing soap scum in any washing process.

Household Calgon is the principal product at Rockwood at present. The basic material is in powdered form, specially processed for rapid solubility. In industrial, commercial and municipal water conditioning, Calgon products are used widely for calcium and iron stabilization, corrosion control, clay and pigment dispersion and in textile and leather processing.

The plant manager at Rockwood is William G Howard. Assistant plant manager is James C Rathburn.

## New Sandoz Color Film

A new color film entitled, "Sandopan DTC", illustrating the firm's crypto-anionic synthetic detergent in the latest types of textile mill dyeing and finishing equipment has been released by Sandoz, Inc.

The movie carries its audience through a 24-minute tour of six textile mills and the pilot plant at the New Bedford Institute of Textiles and Technology.

A sequence of special interest to textile printers and print fabric converters covers the operation of the latest in modern, automatic Swiss printing equipment. Other plant scenes demonstrate the use of Sandoz's surfactant in continuous boiling and bleaching processes; its use on synthetics in the Hinneken boil-off machine; its application in package and beam dyeing, and its adaptation in hosiery scouring and dyeing.

By animated graphs, the film further demonstrates the effectiveness of various types of synthetic detergents on fabrics. Tests on crease recovery, absorbency, and the extraction of

foreign matter from cloth are also covered.

The film is produced in a new type of pastel color by Riverside Pictures, Inc, North Hackensack, NJ. Previous Sandoz films made by Riverside include: "The Story of Silk Printing"; "Metachrome Dyeing with Metomega Chrome Colors"; and "Cuprofix, the Modern Aid to Improved Color Fastness for Cotton and Rayon."

## "New Textile Products from Cotton"

A summary of information on partially acetylated cotton, its preparation, properties, uses, and potential uses, has been published by E M Buras. Jr, and Ralph M Persell, of the Southern Utilization Research Branch of the Agricultural Research Service, USDA, and is available without cost upon request. Considerable research on the preparation and properties of partially acetylated (PA) cotton has been carried out at the Southern Utilization Research Branch. PA cotton is the result of chemical modification of the cotton cellulose molecule; according to the authors, it produces a fiber unchanged from the original in general appearance, and without objectionable properties of odor, color, or toxicity. It is highly resistance to damage from heat and from rot-causing microorganisms. Processes for the batch acetylation of raw stock, yarn, and fabric, and the continuous acetylation of yarn and fabric, are described and illustrated.

PA cotton, processed in accordance with methods developed in the Southern Utilization Research Branch, is produced and marketed in the United States under commercial trade names for household ironing board covers. It is being evaluated for various other uses by a number of industrial organizations. Among suggested potential uses are electrical and thermal insulation, tarpaulins, shower curtains, tents, linings for leather shoes, and a number of other purposes where resistance to damage from heat or mildew and rot is desirable.

Single copies of ARS-72-4, "New Textile Products from Cotton," may be obtained without cost from the Southern Utilization Research Branch, 1100 Robt E Lee Blvd, New Orleans 19, La.

## European Textile Men Visit FRL

Twenty textile mill owners, mill executives, and technical supervisors from Germany, Austria, Holland, and Switzerland visited Fabric Research Laboratories, Inc, Dedham, Mass, on Friday, January 25. The group was led by Ludwig W Halsband of the German Educational Travel Association.

During a tour of the laboratory building, the European showed exceptional interest in the Compactor, a preshrinking machine developed at Fabric Research Laboratories. A lengthy discussion period, led by Francis K Burr, senior research associate at FRL, was centered primarily on geometric fabric constructions and special finishes that have made possible the "wash and wear" fabrics. Several of the visitors inquired about the American industrial system of independent laboratories offering research and development facilities to industry.

The foreign visitors arrived in the United States on January 20 and during their 19-day stay in this country visited textile facilities in New Jersey, Rhode Island, Connecticut, Washington, DC, the Carolinas, and Massachusetts.

## Improved Tear Strength Sought in Resin-Treated Cotton Fabrics

Resin-treated cotton fabrics that wear better and have greater resistance to tearing will be sought in research under a contract recently let by the US Department of Agriculture.

This work is to be done by Fabric Research Laboratories, Inc, Dedham, Mass. The contract was negotiated by the Southern Utilization Research Branch of USDA's Agricultural Research Service.

Crease-resistance that permits cotton wearing apparel to be laundered and worn without ironing can be imparted to the fabric by resin treatment. Large quantities of treated cotton fabrics are being used for this purpose. Development of yarn and fabric structures that would significantly improve the tear strength of resin-treated cotton would be valuable in holding and expanding this market for cotton.

Under the new research contract, commercially available cotton apparel and heavier industrial type fabrics will be studied before and after application of resin, vinyl, and other treatments to determine why these fabrics lose tear strength when treated. Information obtained in these studies should point to modifications in yarn and fabric structures needed to obtain the highest possible tear strength consistent with other desirable fabric properties.

Milton M Platt and George Thomson, directors of Fabric Research Laboratories, Inc, will serve as advisors on the research, and E J Stavrakas will serve as project leader. R J Cheatham will supervise the project for the Southern Utilization Research Branch.

## General Calendar

**AMERICAN OIL CHEMISTS SOCIETY**
Spring, 1957 (Spring meeting, New Orleans); Sept 30-Oct 2, 1957 (Fall meeting, Cincinnati); Apr 21-23, 1958 (Memphis); Oct 20-22, 1958 (Chicago); Spring, 1959 (New Orleans); Fall, 1959 (Los Angeles).

**AMERICAN MATERIAL HANDLING SOCIETY**
Apr 29-May 3 (7th Materials Handling Exposition, Convention Hall, Philadelphia, Pa)

**AMERICAN SOCIETY FOR QUALITY CONTROL**
Feb 25-27—7th Annual Conference of the Textile Division, Georgia Tech, Atlanta, Ga.

**THE DRYSALTERS CLUB OF NEW ENGLAND**
Apr 26 (Hotel Vendome, Boston); June 21 (Annual Outing—Wachusett Country Club, West Boylston, Mass).

**THE FIBER SOCIETY**
Spring Meeting—May 1-2, 1957, The Clemson House, Clemson S C; Sept 4-6 (Joint meeting with the Textile Institute—Hotel Statler, Boston, Mass)

**NATIONAL ASSOCIATION OF HOSIERY MANUFACTURERS**
**NATIONAL KNITTED OUTERWEAR ASSOCIATION**
**UNDERWEAR INSTITUTE**
April 29-May 3 (1957 Knitting Arts Exhibition, Atlantic City, NJ)

**NATIONAL COTTON COUNCIL OF AMERICA**
Feb 28-Mar 1 (Cotton Research Clinic, General Oglethorpe Hotel, Savannah, Ga). October 2-3 (Chemical Finishing Conference—Statler Hotel, Washington, DC)

**PHI PSI FRATERNITY**
April 25-27—Annual meeting, New Bedford Hotel, New Bedford, Mass.

**PHILADELPHIA TEXTILE INSTITUTE ALUMNI ASSOCIATION**
March 1 (56th Annual Banquet, Bellevue-Stratford Hotel, Philadelphia, Pa); June 6-8 (Alumni Day, Alumni Outing, PTI Commencement)

**PURDUE UNIVERSITY**
May 13-15 (12th Purdue Industrial Waste Conference, Purdue Univ, Lafayette, Ind)

**SCALAMANDRE MUSEUM OF TEXTILES**
Jan-Mar, 1957 (Exhibit—"Two Hundred Years of Textile Designs"

**SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES**
Mar 12 (Palm Terrace Suite, Hotel Roosevelt, New York, NY); May 26-28 (Annual Outing, Skytop, Pa); June 11, Sept 10, Oct 8, Nov 12 (Palm Terrace Suite, Hotel Roosevelt, New York, NY)

**TEXTILE QUALITY CONTROL ASSOCIATION**
March 28-29 (Spring Meeting, Clemson House, Clemson, SC)

# • NEW PRODUCTS AND DEVELOPMENTS •

## Schreiner Calendering Improves Nylon Tricot

A well-known textile process—Schreiner calendering—gives promise of assuming a new role in production of nylon tricot with greatly improved character and aesthetic properties, according to studies reported by Du Pont's Textile Fibers Department.

Information developed in a study of finishing techniques indicates that nylon tricot given Schreiner finishing exhibits significantly improved covering power in a measurably thinner fabric. In addition, a smoother, more pleasing hand and new surface appearance are gained.

These advantages, according to Du Pont, offer the tricot industry an opportunity to improve quality fabrics to new high standards. A tricot knit of 40-denier dull nylon when given Schreiner treatment reportedly showed an increase in "see thru cover" as measured by transmitted light of approximately 50 percent, and an increase in "contact cover" as measured by reflected light of approximately 20 percent. The thickness of the fabric reportedly was reduced by 25 to 30 percent as a result of the treatment. The process may be applied to 20-, 30-, and 40-denier tricot and is most effective where dull yarns are used, it is claimed.

Control of time, temperature, and pressure are important for best results. Processing recommendations based on latest data call for calendering between 385 and 400° F under 30 to 45 tons roll pressure at a speed of 19 and 20 yards per minute. These conditions followed by heat setting are said to be sufficient to produce good dimensional stability and durability of the calendered effect to repeated home launderings.

There are various possible sequences for Schreiner calendering of tricot. Calendering in the greige may be possible but has not yet been demonstrated. Calendering of scoured fabrics is said to give a particularly pleasing hand, when followed by wet processing or relaxed heat setting. Treatment as a final step is more convenient for mills which must send fabric out for calendering; processing in the final stage can also be used to give a crisper texture to the fabric. All of the methods investigated thus far are said to have given increased coverage.

The process is carried out on standard Schreiner calendering equipment, commonly available in 48- and 60-inch widths in cotton finishing plants and in many synthetic finishing houses. Several domestic textile machinery manufacturers have reported that they could furnish wide units capable of processing full-width tricot.

Further research by Du Pont is aimed at determining conditions and sequences for maximum advantages through Schreiner calendering of tricot fabrics. Investigations are also under way to demonstrate the effect of Schreiner calendering on woven fabrics.

Schreiner calendering of fabrics made of nylon and other synthetic fibers is still considered to be in its early stages of development. Over the coming years Du Pont anticipates broad acceptance of the process as a finishing treatment for a variety of fabrics made of such thermoplastic fibers as nylon, Orlon, and Dacron.

Further information on this development may be obtained through regional offices of Du Pont's Textile Fibers Department.

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## Sonofin C; Sonolene L

Development of two new textile chemicals—Sonofin C, a softener; and Sonolene L, a detergent—has been announced by the Textile Chemicals Division of L Sonneborn Sons, Inc, New York, NY.

Sonofin C, a 100% active nonionic softener, is recommended by Sonneborn for use with resin and starch finishes on cottons, rayons and synthetics. Extremely fine-particle-size emulsions obtainable with Sonofin C are said to assure uniform application, optimum efficiency and greatest economy. Other claims for the product include high stability, excellent resistance to oxidation and discoloration at elevated temperatures and freedom from any effect on light fastness of dyes.

Sonolene L, a powerful detergent in liquid form, reportedly contains minimum 53% active ingredients. Superior detergency without the use of salts or alkaline builders is claimed for cottons, acetates and acrylics, with excellent white retention. The product is said to be easy to handle and its use to result in goods remaining soft and lofty and print fabrics being clear, bright, sharp and free from crocking. Sonolene L is also recommended for scouring wool, viscose, nylon and Dacron when used with sodium tripolyphosphate or soda ash.

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## Ahcovel X57

Ahcovel X57 is a completely new cationic softener presented by Arnold, Hoffman & Company, Inc, Providence, RI. Described as a truly "universal" textile softener, Ahcovel X57 is said to perform effectively on cotton, viscose and acetate rayons, nylon, Orlon, Dacron, Darlan, etc, and to be of considerable merit in both pure and resin finishes.

On the hydrophobic fibers, the new Ahcovel X57 series reportedly shows antistatic properties. "In this connection," Arnold, Hoffman states, "it is interesting to note that they are unique in their ability to confer antistatic properties to Darlan when applied by substantive application."

Among highly desirable characteristics of Ahcovel X57 cited by Arnold, Hoffman are its ease of solubility in warm (120°F) water, high degree of substantivity, low foaming properties, compatibility with most resin catalysts, and excellent softening for all synthetic and natural fibers. It reportedly will not cause odor to be formed on the fibers, is highly resistant to scorching and yellowing, and will not contribute to chlorine-retention damage. When included in textile resin formulations, Ahcovel X57 does not decrease tear strength or lower crease resistance, it is claimed. It is said to be notably resistant to washing. In respect to the fact that Ahcovel X57 will not contribute to chlorine-retention damage, it is pointed out by Arnold, Hoffman that, for the first time, a cationic substantive softener with excellent all-around qualities can be introduced into a resin formulation with full knowledge that any chlorine damage will be a function of the resin alone.

An important characteristic of Ahcovel X57 stressed by Arnold, Hoffman is that, whether used alone or as a plasticizer for resin finishes, it does not contribute to a loss in tensile strength when subjected to conditions such as are encountered in standard chlorine damage tests.

Ahcovel X57 is available in two forms: a readily soluble, easily workable fluid paste and a soft wax concentrate which contains the maximum concentration of active ingredients allowable for dissolving without use of special techniques.

## Poly-Tergent

The Industrial Chemicals Division of Olin Mathieson Chemical Corporation, Baltimore, Md, is readying a line of nonionic surface-active agents for general industrial use, which it will market under the name Poly-Tergent. The products are expected to have a wide range of applications in the textile field.

Four members of the Poly-Tergent line are being offered initially, with others to follow. All of the first group are alkyl phenol polyglycol ethers. They are liquids made from petroleum-base raw materials.

Poly-Tergent B-200, although intended primarily for use in nonaqueous systems, is dispersable in water. In low concentrations it is said to be an effective wetting agent for cotton in the 32-75°F temperature range, especially under acid conditions. As an emulsifier, the primary function of B-200 is that of an auxiliary emulsifier with the more hydrophilic types, but used alone it reportedly will produce effectively water-in-oil emulsions with various animal and vegetable oils.

Poly-Tergent B-300 is said to possess outstanding properties as a wetting agent, detergent, emulsifier and dispersant. It is soluble in water up to temperatures of 52-56°C and in some organic solvents. Textile applications for which B-300 is particularly suited reportedly include raw-wool scouring, desizing, dyeing and printing, soaping, carbonizing and certain types of finishing. Said to be an excellent detergent, it may be used alone or with the usual mild alkaline builders for scouring cotton, wool, rayon and synthetic fibers. It is reported to be generally more effective in slightly alkaline solutions but will give good results under neutral and acid conditions. Ready rinsability of the product is a characteristic advantage over soap and most synthetic detergents, it is claimed.

Poly-Tergent G-200 is miscible with most organic solvents but is only slightly soluble in water. It is intended primarily as an emulsifying agent and as an associate emulsifier with the more hydrophilic nonionics. It is said to be of value as an additive "soap" in drycleaning solvents, giving clear solutions and making possible the incorporation of small percentages of water.

Poly-Tergent G-300 is completely soluble in water up to 62-70°C and in a number of organics. Unusually stable chemically, it is said to be a good wetting agent, detergent and dispersant over a wide range of conditions of pH, temperature and water hardness. Like B-300, one of its important advantages is ready rinsability. G-300 reportedly imparts good wetting characteristics to all types of textile fibers. Thus it is suitable for use as an assistant in desizing, in bleaching, in dyeing and in after-treatment of prints and dyeings, in wool carbonizing, in kier boiling of cotton, and as a penetrant for many types of finishes.

All of the Poly-Tergents are available in tank cars and in 5-gallon and 55-gallon drums.

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AMI offer

## Instant pH Buffer Solutions

All pH determinations depend on proper standardization of the pH meter with pH buffer solutions. It is now only necessary to empty the contents from a sealed, vapor-proof envelope into a large-mouthed polyethylene bottle and add distilled water to the bottom of the neck. The dispenser is screwed to the neck, and after being shaken thoroughly, a fresh bottle of buffer is ready for use.

Analytical Measurements, Inc, Chatham, NJ, is making a special introductory offer of three polyethylene squeeze bottles labelled for pH 4, pH 7, and pH 9, which covers standardization values required in most applications. Three envelopes of each value, making 500 ml of solution, provides nine bottles each of 500-ml volume. Since the powders are sealed in a vapor-proof envelope, it is claimed that they may be stored as long as several years without deterioration.

The entire kit providing nine 500-ml bottles of solution of pH 4, pH 7, and pH 9, sells for $6.00, postpaid.

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## Softener 64

A 100%-active amide softener is now available through Glyco Products Co Inc, Empire State Bldg, New York, NY. Designated as Softener 64, it is described as a white, waxy solid of low surface tension that disperses in hot water.

It is said to be easily converted to a cationic softener by adding a little acetic or formic acid to a water dispersion. It is also said to be unusually resistant to high processing temperatures and hot pressing and to give a maximum whiteness on white surfaces. It is claimed that Softener 64 will not affect the colors on dyed or printed goods.

Because Softener 64 does not contain water or inert material, it is said to be very economical to use, only 0.25-1.0% of the weight of the goods treated being necessary. It reportedly is being used to good advantage by a number of textile mills.

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## Lanasyn Brown 2RL

Recommended by the manufacturer for its superior fastness to light and to decatizing, Lanasyn Brown 2RL is a new Sandoz premetallized colorant for the neutral dyeing of wool or nylon. Among its characteristics and applications, the following are mentioned especially: production of a good union on silk and wool by common salt method; greenness in artificial light; superior fulling; high resistance to the effects of iron and copper; desirable orange overhand in daylight.

Leaflets on Lanasyn Brown 2RL have been prepared by Sandoz, Inc, 61 Van Dam Street, New York 13, NY, and are available at the company's dyestuff sales offices.

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## GMA

A new chemical building block—glycidyl methacrylate—is being offered in experimental and pilot plant quantities by the Du Pont Company Finishes Division as a convenient way of introducing epoxide groups into vinyl polymers or vinyl groups into condensation polymers.

GMA (glycidyl methacrylate) technical data and samples may be obtained from Room 7021-D, Du Pont Company, Wilmington 98, Delaware.

Physically, glycidyl methacrylate is a light-colored, almost odorless liquid. The monomer reportedly may be polymerized or copolymerized through the double bond and further reacted through the epoxide, or the oxirane ring may be first polymerized so as to leave the vinyl group available for cross-linking. It is claimed that GMA will polymerize thermally, with ultraviolet light, or with the usual free radical or ionic polymerization catalysts. Thus, copolymers may be made containing any desired amount of functional groups by varying the proportion of GMA in the monomer charge.

GMA is being supplied at a development price of $5.00 a pound.

# • NAMES IN THE NEWS •

The Board of Directors of Smith, Drum & Company, Philadelphia manufacturers of textile dyeing and finishing machinery, has announced the election of the following officers:

*Chairman of board:* **Harry S Drum**
*President:* **Robert N Smith**
*Vice-president:* **Albert Bagian**
*Treasurer:* **William H Gray**

Mr Smith is the grandson of Robert P Smith, one of the original founders of the business. He has been associated with the company for over 15 years, the past 6 years as executive vice president.

Mr Bagian was previously sales manager and has been with the company since 1945. In his new capacity, he will be in charge of sales, engineering and machinery development.

Mr Gray joined Smith, Drum & Company in 1950 as controller.

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**Lawrence H Flett,** consultant to National Aniline Div, Allied Chemical & Dye Corp, will receive honorary membership in the American Institute of Chemists at a dinner meeting March 11 at the Hotel Commodore. Mr Flett will address the group on "Pursuit of Invention."

In his 35 years of service with National Aniline, Mr Flett accumulated some 75 patents and authored numerous scientific papers. He is co-author of several books, the most recent of which is, "Maleic Anhydride Derivatives."

**Murray Berdick,** Evans Research & Development Corp, chairman of the New York Chapter, AIC, will begin the meeting at 8:15 pm. **Glen B Miller,** vice president of Allied Chemical & Dye Corp, will discuss Flett as an industrial chemist. **James W Perry,** Western Reserve University, will discuss Flett, the person and **Walter J Murphy** of the American Chemical Society Publications will discuss Flett, the professional chemist. **John H Nair,** Thomas J Lipton, Inc, the national president of the American Institute of Chemists, will make the award of the honorary membership.

The dinner will be in the Commodore's Century and South Room at 7:00 pm. It will be preceded by a 6:00 pm reception by courtesy of the Allied Chemical & Dye Corporation. Dress is optional; black tie on dais. Dinner tickets will cost $8.50 at the door. Reservations at $8.00 per plate may be made with F A DeAngelis, Foster D Snell, Inc, 29 West 15th Street, New York 11, NY.

**Damon**

Refined Products Corp, Lyndhurst, NJ, has announced the appointment of **A Durfee Damon** as technical sales representative for the Hudson Valley area of New York State.

Mr Damon's twenty-five years of experience in the textile field include service with Deering, Milliken & Co, as a chemist in the laboratory, dyehouse technician, foreman of bleaching department, chief chemist, assistant superintendent, plant superintendent, and general manager. He developed, organized and was appointed manager of the Company's new division for the manufacture of nonwoven fabrics.

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**Carl H Mueller** has been named technical advisor to the executive vice president of General Aniline & Film Corp.

Dr Mueller, who has been with GAF since 1941, has been serving as technical assistant to the vice president and general manager of GAF's Dyestuff and Chemical Division since March, 1954. In his new position he will advise the president as well as the executive vice president on technical matters of major importance to the Corporation with particular attention to the areas of research and development. He will also assist in coordinating the research efforts of the various divisions of the Company in areas of mutual interest and will investigate new fields for corporate research.

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**E J Lukas** has been appointed manager of the export department, Organic Chemicals Division, American Cyanamid Company.

He succeeds **J C Martin,** who has been named special consultant to the department on export markets.

Mr Lukas has been with Cyanamid since 1952. In his new position, he becomes the youngest commercial department manager in the Organic Chemicals Division.

**Charles W Dorn** has been named director of Dexter Chemical Corp's textile testing laboratories.

Mr Dorn retired last year as director of research of the J C Penney Co after 26 years in that capacity. He is chairman of the Executive Committee on Research of the American Association of Textile Chemists and Colorists and is recognized as one of the leaders in the field of textile standards and testing procedures.

He will continue as consultant to Sanitized, Inc, in addition to his work at Dexter.

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**D S Alcorn** has been appointed assistant manager and **T J Hall** product manager of fine chemicals in the Fine Chemicals Department of Carbide and Carbon Chemicals Co, a division of Union Carbide and Carbon Corp.

Mr Alcorn has been associated with the Company since 1943 chiefly in marketing and product development activities. As a technical representative he helped develop many of the Company's chemicals for textile applications. As a product manager, his field of interest was aromatic, nitrogen, and chlorine compounds. In his new position as assistant manager he will add the development of acrolein and peracetic acid markets to his responsibilities in these fields.

Dr Hall's responsibilities at Carbide and Carbon since 1952 have included the development of markets for chemical intermediates. His particular areas of interest have been acrolein and reactive peracetic acid and their derivatives.

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**George A Leeper** has joined the Phoenix staff of Desert Sunshine Exposure Tests, Phoenix, Ariz, as assistant director.

Mr Leeper spent over two years with Allied Chemical & Dye Corp, South Point, Ohio, before moving West.

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**Bruce M Bare** has been appointed marketing manager of Atlas Powder Company's Chemicals Division.

Mr Bare joined Atlas from the Dewey and Almy Chemical Company, where he served most recently as marketing manager of the organic chemicals division.

Shutts

Several promotions and a number of new assignments within the sales department of Becco Chemical Division, Food Machinery and Chemical Corporation, Buffalo, NY, have been announced.

**Albert P Shutts**, New York district sales manager for the past two years, has been promoted to assistant sales manager of the Division. Mr Shutts joined Becco in 1946 as a field representative in the New York territory. He will make his new headquarters at the company's main office in Buffalo.

**Matthew A Noonan**, since 1946 manager of the Philadelphia territory, has been promoted to New York district manager, and will now have charge of both the Philadelphia and the New York territories which are being consolidated. Mr Noonan came to Becco in 1936 as a member of the research department.

**Paul U Bretschger**, who has been a field representative in the Western New York territory, has been promoted to manager of this territory, which has now been enlarged to include not only upstate New York but also western Pennsylvania, formerly part of the Philadelphia territory. Mr Bretschger joined Becco in 1949.

**Edward M Roth** has been appointed assistant New York manager, to share the expanded responsibilities of Mr Noonan. Mr Roth joined Becco's research department in 1948 and was assigned to the New York territory as a field representative in March, 1955.

**George J Motz** has been added to the New York area sales staff, and **Eugene M McMahon**, a recent sales trainee, has been assigned as a field representative in the Philadelphia area.

**Richard T Mould**, another recent sales trainee, has been appointed to the Midwest district sales staff in Chicago. He joined Becco in 1955.

**Bruce J Bishop** has joined the Becco sales organization and is currently assigned to the Southern territory office in Charlotte, NC.

**Robert B Lautner** has been named manager of the Moundsville, W Va, chlorine-caustic soda plant of Solvay Process Division, Allied Chemical & Dye Corporation. He succeeds **W E Dugan, Jr**, who died suddenly December 28th.

Mr Lautner's post as assistant manager has been filled with the appointment of **John L Rourke**, superintendent of Electrolytic operations at Solvay's Syracuse plant.

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The promotion of **Dorrance H Goodwin** to the position of executive director of the Lowell Technological Institute Research Foundation has been announced.

Formerly assistant manager of the industrial division of the Goodall-Sanford Co, Sanford, Me, Mr Goodwin has been director of research services at the LTI Research Foundation since November, 1954.

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**John J Conlin** has been appointed assistant director of admissions at the Philadelphia Textile Institute.

Immediately following his graduation from PTI in 1956 he was employed by the Lockport Felt Company, Newfane, N Y, as an assistant chemist, a position he held until transferring back to his alma mater.

## OBITUARY

### FERDINAND W BRETH

**FERDINAND W BRETH, vice president and technical director of L Sonneborn Sons, Inc, New York, N Y, died January 8 of a heart attack while en route to a New York hospital. His age was 70.**

**A native of Bohemia, Dr Breth joined the Sonneborn organization in 1915, established a research laboratory at the firm's Nutley, NJ, manufacturing plant and remained there for five years as director of research. He then transferred to Sonneborn's refinery at Petrolia, Pa, and there established and directed one of the early petroleum research laboratories. A few years following, he established similar research facilities at another refinery which Sonneborn acquired at Franklin, Pa. Functioning as vice president and research director, he had divided his time for approximately the last 20 years between the Sonneborn refineries and the firm's main offices in New York.**

**Dr Breth was a member of the American Chemical Society, the American Society for Testing Materials and the Chemists Club. In association with others, he received several US patents.**

Coleman

**H E Coleman** has joined the Polychemicals Division of West Virginia Pulp and Paper Company as sales manager.

Mr Coleman has ten years of broad marketing experience in the chemical field as salesman, assistant sales manager, and most recently as general sales manager of the Kelco Company.

The Polychemicals Division has developed and is manufacturing and marketing a broad line of highly refined lignins, lignosulfonates, and other lignin derivatives.

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The following organizational changes at the U S Customs Laboratory, 201 Varick St, New York, NY, became effective Feb 1, 1957:

**I Schnopper** is the assistant chief chemist, replacing **H W Eckweiler**, retired.

**David Moran** is chief of the new Textile and Dye Division, which, in effect, replaces the Textiles and Dyes Section of the Coal Tar, Fiber and Miscellaneous Division.

**J O Broussard** is chief of the new Intermediates, Sugars, Plastics and Miscellaneous Division, which, in effect, consists of the two sections of the Coal Tar, Fiber and Miscellaneous Division known as Intermediates and Sugars Section and Plastics and Miscellaneous Section.

**C E Augner** has succeeded Mr Broussard as chief of the Inorganic Division.

The new organization now consists of the chief chemist, **Edward F Kenney**; the assistant chief chemist, Mr Schnopper; and the chiefs of five divisions. In addition to the abovementioned chiefs, **Anthony J DiDomenico** heads the Administrative Division, and **Belle Kahn** heads the Organic Division.

After 33 years with the Bureau Mr Eckweiler retired on December 31, 1956. He is entering the consultant field, confining his efforts to the tariff aspects of the chemical, mineral, and allied fields.

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